STORMWATER MANAGEMENT REPORT

for

ONE PARK
27 Park Road
West Hartford, Connecticut

Prepared for:

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140184201

LANGAN

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EXECUTIVE SUMMARY

This stormwater management report has been prepared in support of the proposed One Park development to be located at 27 Park Road in the town of West Hartford, Hartford County, Connecticut. The development includes construction of a five-story residential building. This proposed building will connect to existing residential buildings that are to remain. Site improvements include a pool and pool house, parking, driveways, walkways, utilities, drainage, and landscaping.

The site is ±21 acres with the proposed development to encompass approximately half the site. The site is bordered by Park Road to the north, Prospect Avenue to the east, Kennedy Memorial Park to the south, and Ringgold Street to the west (see Figure 1). The existing site grades range from approximately el. 42 to el. 79, with the majority of the development taking place above elevation 45.

Hydrologically, the site is located in the South Branch Park River Sub-regional Watershed. The South Branch Park River Sub-regional Watershed is approximately 25,400 acres, of which the site encompasses a nominal amount of total watershed area. Stormwater runoff from the site is either collected in on-site drainage structures which eventually discharge to an on-site wetland or flows overland to the town drainage systems within Park Road and Prospect Avenue. Parts of the site are located in the FEMA Flood Zone X (Shaded) and Flood Zone A (See Figure 2).

The proposed stormwater management system has been designed in accordance with the town of West Hartford Design Requirements; guidance provided by the West Hartford Engineering Department, the 2004 Stormwater Quality Manual, and the 2000 CT DOT Drainage Manual. The system incorporates significant stormwater quality measures and maintains or decreases the rate of runoff for all storms analyzed.

It is the opinion of this office and the findings of this report that the proposed stormwater system, as designed, will effectively manage the stormwater runoff for quality and quantity for the proposed development.

1.0 INTRODUCTION

1.1 General

This stormwater management report has been prepared in support of the proposed One Park development to be located at 27 Park Road, West Hartford, Connecticut. This report addresses the engineering design of the stormwater conveyance and management systems for the site.

1.2 Site Location

The development is located on a ±21-acre property bordered by Park Road to the north, Prospect Avenue to the east, Kennedy Memorial Park to the south and Ringgold Street to the west (see Figure 1).

1.3 Existing Conditions

The site is developed with existing buildings partially occupied by the Sisters of St. Joseph. Areas outside of the buildings include parking areas, lawn, and two (2) wetland areas. An isolated wetland area exists near the southern property line while a larger wetland area (hereon in known as "wetland") contains an existing watercourse located to the south and west of the development. Existing grades on site range from approximate el. 42 to el. 79, with the majority of the development taking place above elevation 45.

1.4 Project Description

The development includes construction of a five-story residential building. Site improvements include a pool and pool house, parking, driveways, walkways, utilities, drainage, and landscaping.

1.5 FEMA

According to the Flood Insurance Study of Hartford County, Connecticut conducted by the Federal Emergency Management Agency (FEMA), parts of the site are in the FEMA Flood Zone X and Flood Zone A (See Figure 2).

Zone A is an area subject to inundation by the 1 percent annual chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no base flood elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Zone X is considered a Moderate Risk Area and described by FEMA as areas of areas within the 0.2 percent, annual, chance floodplain; areas of 1-percent, annual, chance flooding where average depths are less than 1 foot; areas of 1-percent, annual chance flooding where the contributing drainage area is less than 1 square mile; and areas protected from the 1 percent, annual, chance flood by a levee. No base flood elevations or base flood depths are shown within these zones.

A small portion of the development will include filling of approximately 850 cubic yards within the FEMA Flood Zone A. We are proposing to provide compensatory storage of this volume in the southeastern portion of the site.

1.6 Soil Conditions

According to the USDA Natural Resources Conservation Service Web Soil Survey, the site soil type is predominantly Udorthents – Urban land complex (See Figure 3). The Web Soil Survey has classified these soils as soil Group B and C.

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
28A	Elmridge fine sandy loam, 0 to 3 percent slopes	12.8	5.0%
225B	Brancroft-Urban land complex, 0 to 8 percent slopes	16.6	6.5%
228B	Elmridge-Urban land complex, 0 to 8 percent slopes	45.3	17.6%
240B	Ludlow-Urban land complex, 0 to 8 percent slopes	0.5	0.2%
304	Udorthents, loamy, very steep	4.4	1.7%
306	Udorthents-Urban land complex	58.4	22.7%
307	Urban land	102.9	40.1%
308	Udorthents, smoothed	15.9	6.2%
Totals for Area of Interest		**256.8**	**100.0%**

Table 1: NRCS Soil Survey

A summary of the basic characteristics of the soils series present on site are outlined below:

Udorthents-Urban Land Complex (306) - The Urban Land series consists of nearly level and gently sloping excavated and filled land for construction projects. Permeability is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is moderate.

Urban Land (307) - The Urban Land series consists of nearly level and gently sloping excavated and filled land for construction projects. Available water capacity is low.

Soils are classified into hydrologic soil groups (HSG) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSGs, which are A, B, C and D, are one element used to determine runoff curve numbers and analyzing stormwater characteristics of a site.

Group A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist of mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C soils have a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D soils have a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D) the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

2.0 STORMWATER MANAGEMENT

2.1 Design Criteria

Proposed peak flow rates at all points of discharge from the site were analyzed to compare proposed discharge rates with the existing condition.

The storms analyzed include the following:

- A 2-year, 24-hour storm consisting of 3.30 inches of rainfall
- A 10-year, 24-hour storm consisting of 5.30 inches of rainfall
- A 25-year, 24-hour storm consisting of 6.54 inches of rainfall
- A 100-year, 24-hour storm consisting of 8.46 inches of rainfall

These events are based on the West Hartford rainfall data obtained by NOAA.

2.2 Design Methodology

The peak runoff discharges for the existing and proposed conditions were analyzed using Soil Conservation Service (SCS) methodology, which outlines procedures for calculating peak rates of runoff resulting from precipitation events, and procedures for developing runoff hydrographs. Values for area, curve number and time of concentration were calculated for the existing and proposed conditions.

The curve number "CN" is a land-sensitive coefficient that dictates the relationship between total rainfall depth and direct storm runoff. The soils within the watershed are divided into hydrologic soil groups (A, B, C and D). The SCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have the lowest runoff potential, and "D" soils have the greatest runoff potential. Soils within the development area predominantly have a hydrologic soil group designation of "B" and "C."

The time of concentration, Tc, is defined as the time for runoff to travel from the hydraulically most distant point in the watershed to a point of interest. Values of time of concentration were determined for existing and proposed conditions based on land cover and slope of the flow path, using methods outlined in the SCS methodology.

For this study, a 24-hour SCS Type III standard rainfall distribution was used to determine the peak flow rate to all points of discharge from the site.

2.3 Existing Runoff Discharges (See Appendix A for Calculations)

The existing drainage conditions were delineated in three (3) watershed areas: A, B and C (See EX-WS).

Watershed A, consisting of ±10.43 acres, comprises the majority of the site as well as the existing building, parking lot, and part of the existing lawn area south of the building. Runoff from this watershed flows directly into the on-site wetland.

Watershed B, consisting of ±1.43 acres, comprises part of the existing building, parking lot and lawn area at the north of the property near Park Road. Runoff from this watershed flows into Park Road, drains west into existing catch basins on Park Road. These catch basins convey collected runoff through a 15-inch reinforced concrete pipe (RCP) into the 18-inch RCP town drainage system.

Watershed C, consisting of ±0.15 acres, comprises primarily of landscaped grass and vegetation along Prospect Avenue. Stormwater runoff from this watershed flows into an existing catch basin located in Prospect Avenue. This catch basin conveys collected runoff through a 12-inch reinforced concrete pipe (RCP) into the town drainage system.

2.4 Proposed Runoff Discharges (See Appendix B for Calculations)

The proposed development area has been delineated into three watershed areas A, B, and C. These watersheds contribute to the same analysis points as described in section 2.3 above. To accurately model and route the proposed runoff through the various stormwater management features, the watersheds have been further divided and combined into sub-watersheds labeled A-1, A-2, A-3, B, and C (See PR-WS).

Watershed A-1, ±3.44 acres, comprises most of the existing building's roof and most of the northern portion of the site, including the interior courtyard areas between the existing and proposed buildings. Stormwater from this watershed will be collected in on-site catch basins and conveyed by a closed pipe network into the proposed underground detention system #1 within the parking area in the western portion of the site. An outlet control structure has been designed to manage discharge flow rates to the existing on-site wetland.

Watershed A-2, ±4.62 acres, comprises the remainder of the existing building and all of the proposed building roof areas, existing lawn areas on the eastern portion of the site, and the southern parking area. Stormwater from this watershed will be collected in on-site catch basins and conveyed by a closed pipe network into the proposed underground detention system #2 located within the parking area in the southern portion of the site. An outlet control structure

has been designed to manage discharge flow rates to the existing on-site wetland.

Watershed A-3, ±3.46 acres, is composed of the site's western and southern landscaped area directly upstream of the wetland. This area is to remain mostly undisturbed except for a small portion adjacent to Prospect Avenue where the compensatory storage for the site's floodplain will be located. Stormwater runoff from this watershed sheet flows down the vegetated slope directly into the on-site wetland.

Watershed B, consisting of ±0.38 acres, is composed of the northern landscaped area adjacent to Park Road. This watershed will remain mostly unchanged from existing conditions. Runoff from this watershed flows into Park Road and drains west into existing catch basins on Park Road. These catch basins convey collected runoff through a 15-inch reinforced concrete pipe (RCP) into the 18-inch RCP town drainage system.

Watershed C, ±0.11 acres, is comprised of the eastern landscaped area adjacent to Prospect Avenue. This watershed will remain mostly unchanged from existing conditions. Stormwater runoff from this watershed will continue to flow into an existing catch basin on Prospect Avenue. This catch basin conveys collected runoff through a 12-inch reinforced concrete pipe (RCP) into the town drainage system.

Table 2: Peak Runoff Flow Comparison (CFS)

	2-YEAR		10-YEAR		25-YEAR		100-YEAR	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Drainage to Wetland (WS-A)	11.07	7.55	26.67	25.98	37.15	36.12	53.82	51.54
Drainage to Park Road (WS-B)	1.90	0.43	4.36	1.12	5.98	1.59	8.54	2.35
Drainage to Prospect Ave. (WS-C)	0.15	0.18	0.41	0.40	0.59	0.54	0.89	0.77
Total Site Discharge	12.99	7.78	31.13	26.85	43.26	37.53	62.66	53.57

Although the development results in an increase to the impervious cover of the site, the stormwater management system has been designed to provide peak-flow attenuation and result in a decrease in peak discharge rates between pre- and post-development conditions.

Our opinion is that the stormwater management system, as designed, will have no impact on the function of the existing on-site wetland or the town drainage system.

3.0 STORMWATER QUALITY

3.1 Stormwater Quality Improvements

The stormwater management system has been designed in accordance with the Connecticut DEP Stormwater Quality Manual and the Connecticut DEP Soil Erosion and Sediment Control Manual. The underground detention chambers have been designed to accept stormwater runoff from the roof and majority of the developed area. To provide pretreatment of stormwater entering the two detention system inlets, two filter fabric wraps, Isolator Rows®, have been provided to enhance the removal of Total Suspended Solid (TSS). Calculations have been provided for the sizing of each of these Isolator Rows® (See Appendix D).

3.2 Additional Stormwater Quality Features

In addition to the Isolator Rows® described above, the following additional water-quality control measures will be provided:

Catch basins with sumps: Catch basins at the site are to be constructed with sumps (minimum 2 feet) to prevent discharge of sediments. Catch basins will be cleaned two times per year.

4.0 STORM DRAINAGE COLLECTION SYSTEM DESIGN (See Appendix C for Calculations)

4.1 Design Criteria

The proposed subsurface storm drainage collection system is designed to convey the 10-year design storm event per the Town of West Hartford requirements. The isolated yard drain enclosed in the courtyard with no overland free-flow release has been designed to convey the 100 year storm event. All underground conveyance networks have been designed with 1 foot of freeboard between the HGL and the top of structure frames.

4.2 Design Methodology

The storm-drainage system was analyzed using the Rational Method for estimating runoff for a 10-year design storm event. The site was divided into subareas, each contributing runoff to an individual catch basin inlet or roof drain. A value for area, time of concentration, and a runoff coefficient was calculated for each contributing subarea.

Values of time of concentration were chosen based on land cover and slope of the flow path from the hydraulically most distant point in the subarea to the appropriate inlet. The average runoff coefficient, which is the ratio of peak runoff rate to the average rainfall rate for the period known as the time of concentration, was chosen using the following values:

CONDITION	C
Grass/Landscaping	0.30
Paved/Impervious	0.90
Roof Areas	0.95

Rainfall intensities were taken from the intensity-duration-frequency curve for Connecticut as presented in the Connecticut DOT Drainage Manual, 2000. Storm-drainage pipes were then sized based on calculated flows using Manning's Equation and were verified by solving for the hydraulic grade line. Starting hydraulic grade lines for the pipe networks were set to the calculated

maximum water elevations for the 10-year-design storm event within the analyzed drainage network.

4.3 Storm Drainage Collection Summary

The runoff from the development will be collected using conventional roof drains, catch basin, and manhole system. The collection system was designed to convey the 10-year storm with a 1 foot free board before overtopping any of the proposed catch basins on site. The enclosed courtyard drainage has been designed based on assumed 100% impervious surface and for conveyance of a 100 year design storm.

In addition, the main "trunk" line of the system has been analyzed without taking into consideration the flow attenuation from the underground system in order to ensure pipes have capacity in the event of a problem with the underground detention systems.

5.0 CONCLUSION

The proposed stormwater management system has been designed in accordance with the town of West Hartford Design Requirements, guidance provided by the town of West Hartford Engineering Department, the 2004 Stormwater Quality Manual, and the 2000 CT DOT Drainage Manual. The system incorporates significant stormwater quality measures and maintains or decreases the rate of runoff for all storm events analyzed.

It is the opinion of this office and the findings of this report that the proposed stormwater system, as designed, will effectively manage the stormwater runoff for quality and quantity for the proposed development.

6.0 REFERENCES

1. Town of West Hartford Zoning Regulation

2. Connecticut Guidelines for Soil Erosion and Sediment Control, The Connecticut Council on Soil and Water Conservation, 2002.

3. Soil Survey of Hartford County, Connecticut, United States Department of Agriculture, 1958.

4. Urban Hydrology for Small Watersheds, Technical Release 55, United States Department of Agriculture, Soil Conservation Service, June 1986.

5. Connecticut Stormwater Quality Manual, Connecticut Department of Environmental Protection, 2004.

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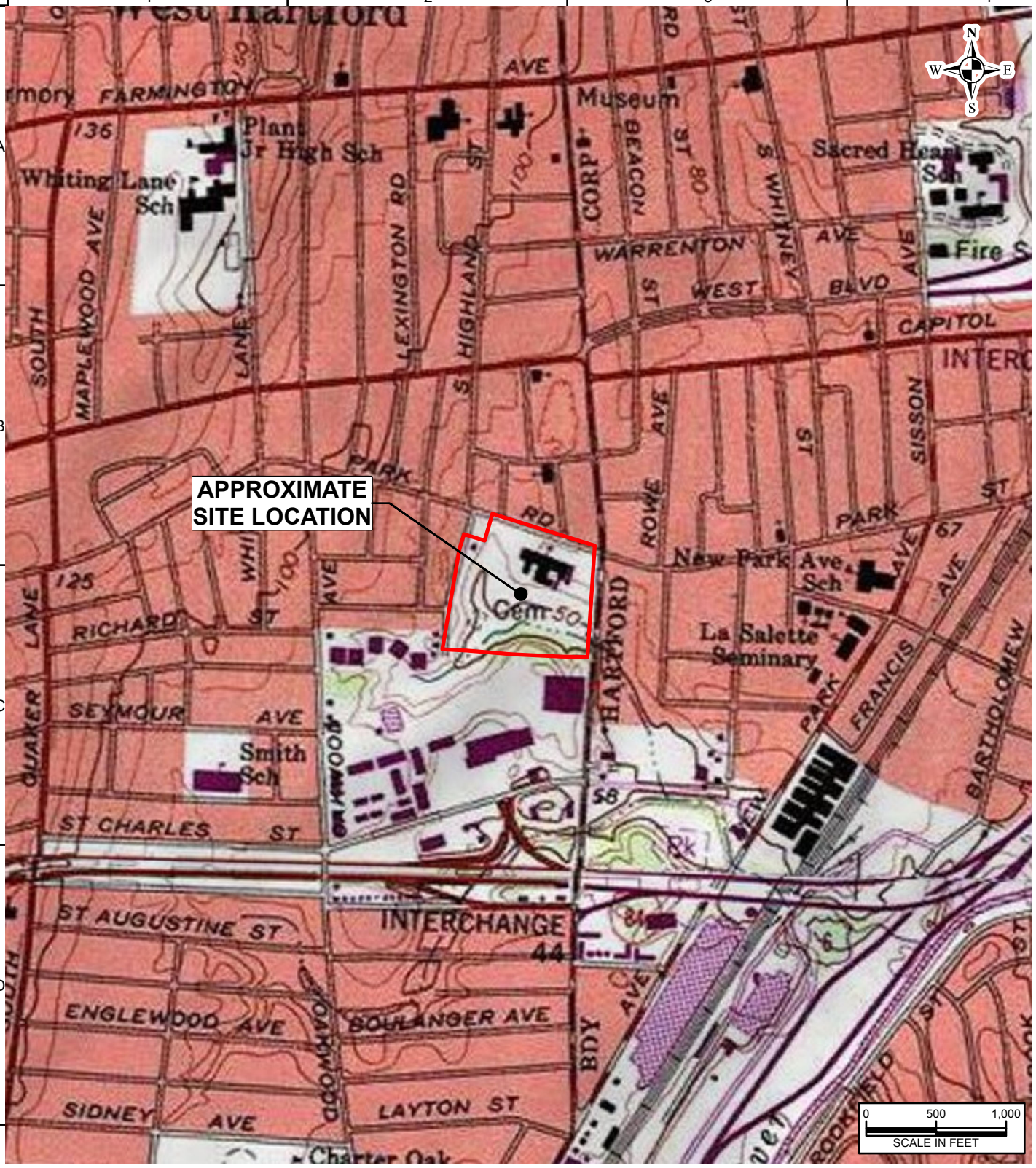
LIST OF FIGURES

LIST OF MAPS



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NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

Project
ONE PARK
WEST HARTFORD CONNECTICUT

USGS LOCATION MAP

Spatial Reference: NAD 1983 StatePlane Massachusetts Island FIPS 2002 Feet

Project No. 140184201	Figure 1
Date 8/15/2018	
Scale 1:1,000	
Drawn By Site Analyzer	
Submission Date 08/15/2018	Sheet 1 of 3

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FEMA MAP

Spatial Reference: NAD 1983 StatePlane Massachusetts Island FIPS 2002 Feet

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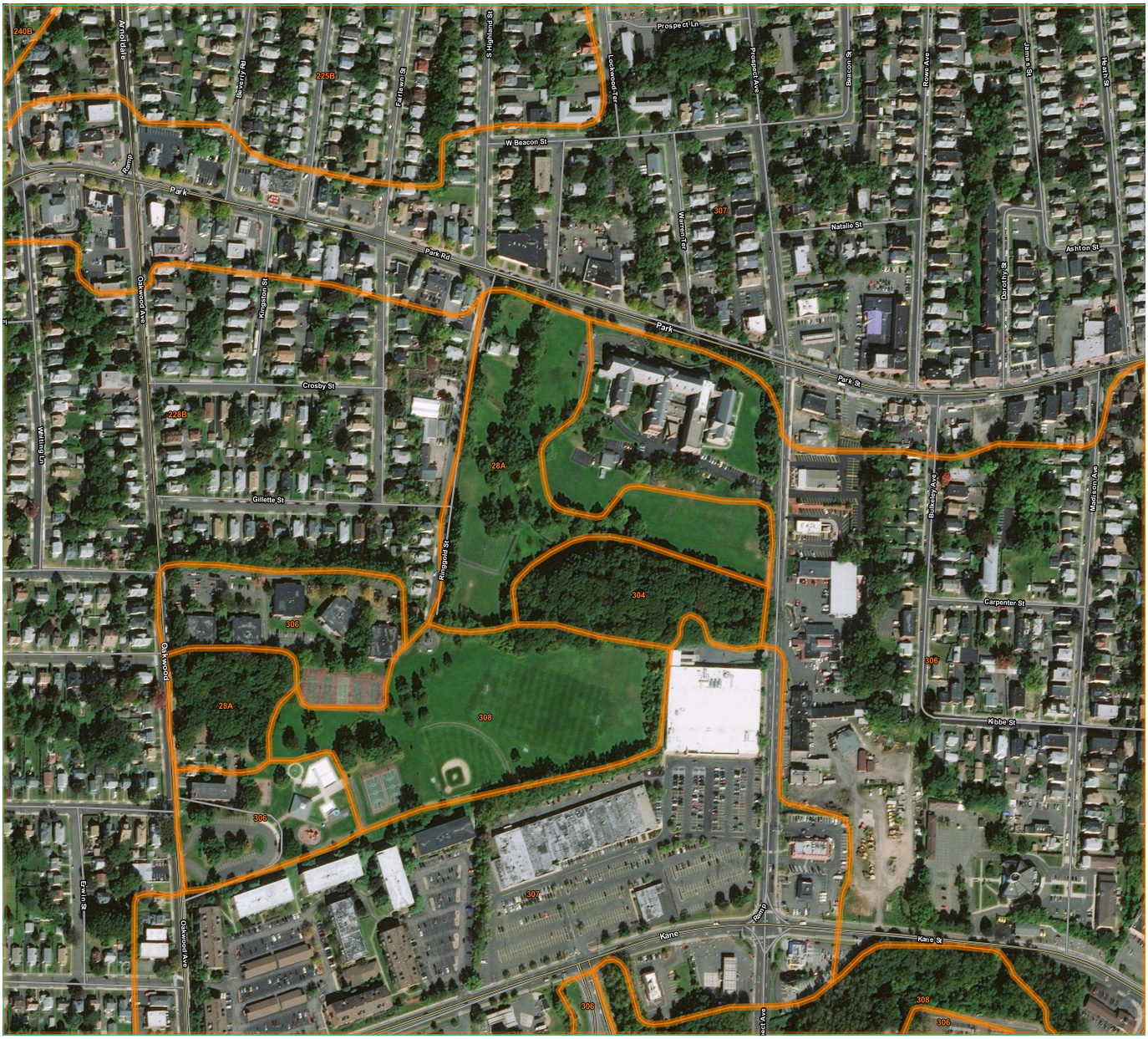
Submission Date 08/15/2018	Sheet 2 of 3



MAP UNIT SYMBOL	MAP UNIT NAME
28A	Elmridge fine sandy loam, 0 to 3 percent slopes
225B	Bancroft - Urban land complex, 0 to 8 percent slopes
228B	Elmridge - Urban land complex, 0 to 8 percent slopes
240B	Ludlow - Urban land complex, 0 to 8 percent slopes
304	Udorthents, loamy, very steep
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307	Urban Land
308	Udorthents, smoothed

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Project
ONE PARK
WEST HARTFORD CONNECTICUT

SOILS MAP

Spatial Reference: NAD 1983 StatePlane Massachusetts Island FIPS 2002 Feet

Project No. 140184201	Figure 3
Date 8/15/2018	
Scale N.T.S	
Drawn By NCW	
Submission Date 08/15/2018	Sheet 3 of 3

GENERAL NOTES

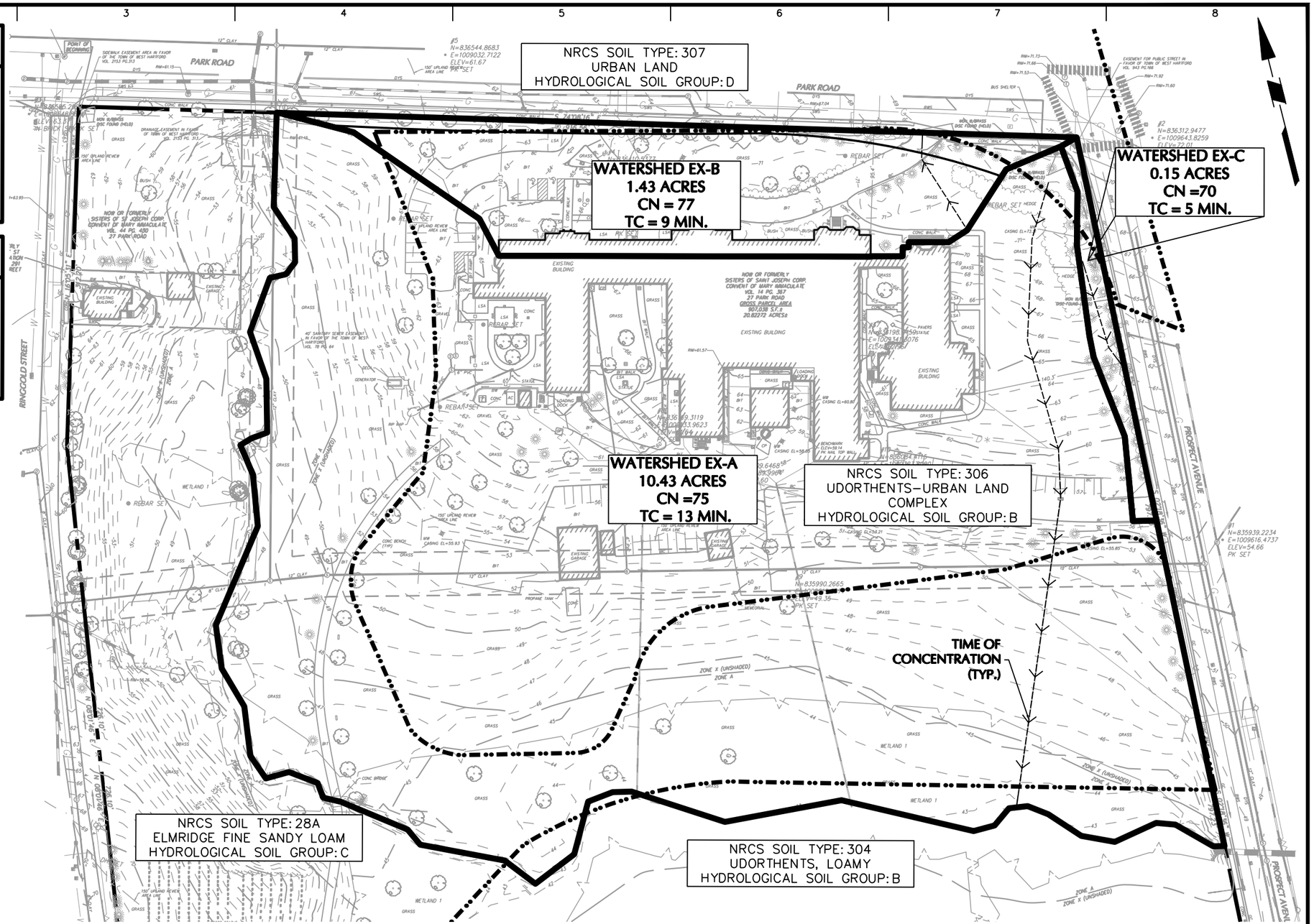
1. EXISTING BOUNDARY & TOPOGRAPHIC INFORMATION OBTAINED FROM A MAP TITLED "BOUNDARY & TOPOGRAPHIC SURVEY" PREPARED BY LANGAN ENGINEERING & ENVIRONMENTAL SERVICES, DATED OCTOBER 26, 2018.
2. THE SITE CONTAINS AREAS WITHIN ZONE "A" FLOODPLAIN PER FIRM MAP #09003C0364F, EFFECTIVE SEPTEMBER 26, 2008.

LEGEND

WATERSHED BOUNDARY

TIME OF CONCENTRATION

SOIL BOUNDARY



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SCALE IN FEET

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Project
ONE PARK
WEST HARTFORD CONNECTICUT

Drawing Title
EXISTING DRAINAGE AREA PLAN

Project No. 140184201	Drawing No. EXWS
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Drawn By IV / Checked By NLK	

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GENERAL NOTES

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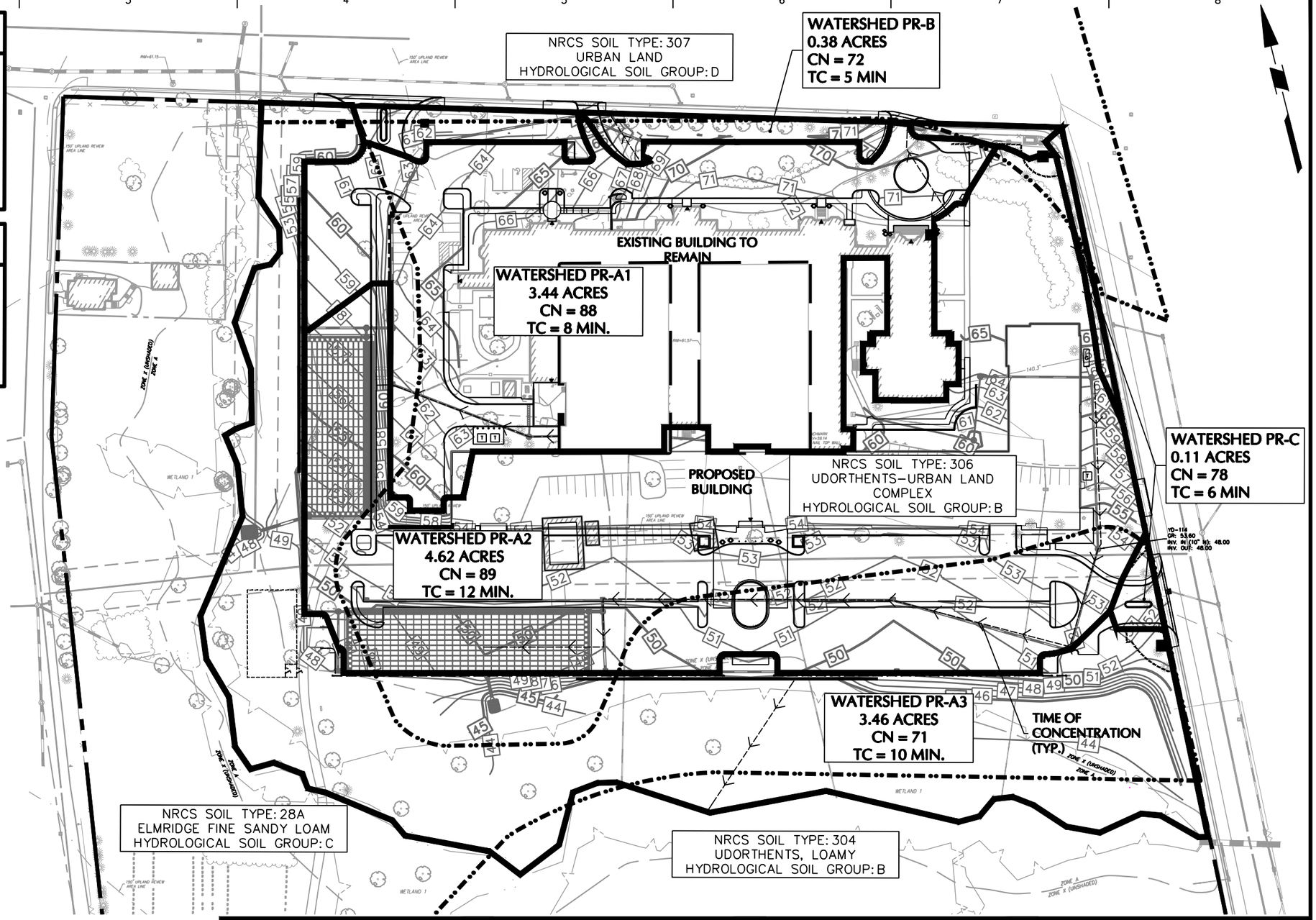
LEGEND

WATERSHED BOUNDARY

TIME OF CONCENTRATION

SOIL BOUNDARY



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ONE PARK
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Drawing Title
PROPOSED DRAINAGE AREA PLAN

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GENERAL NOTES

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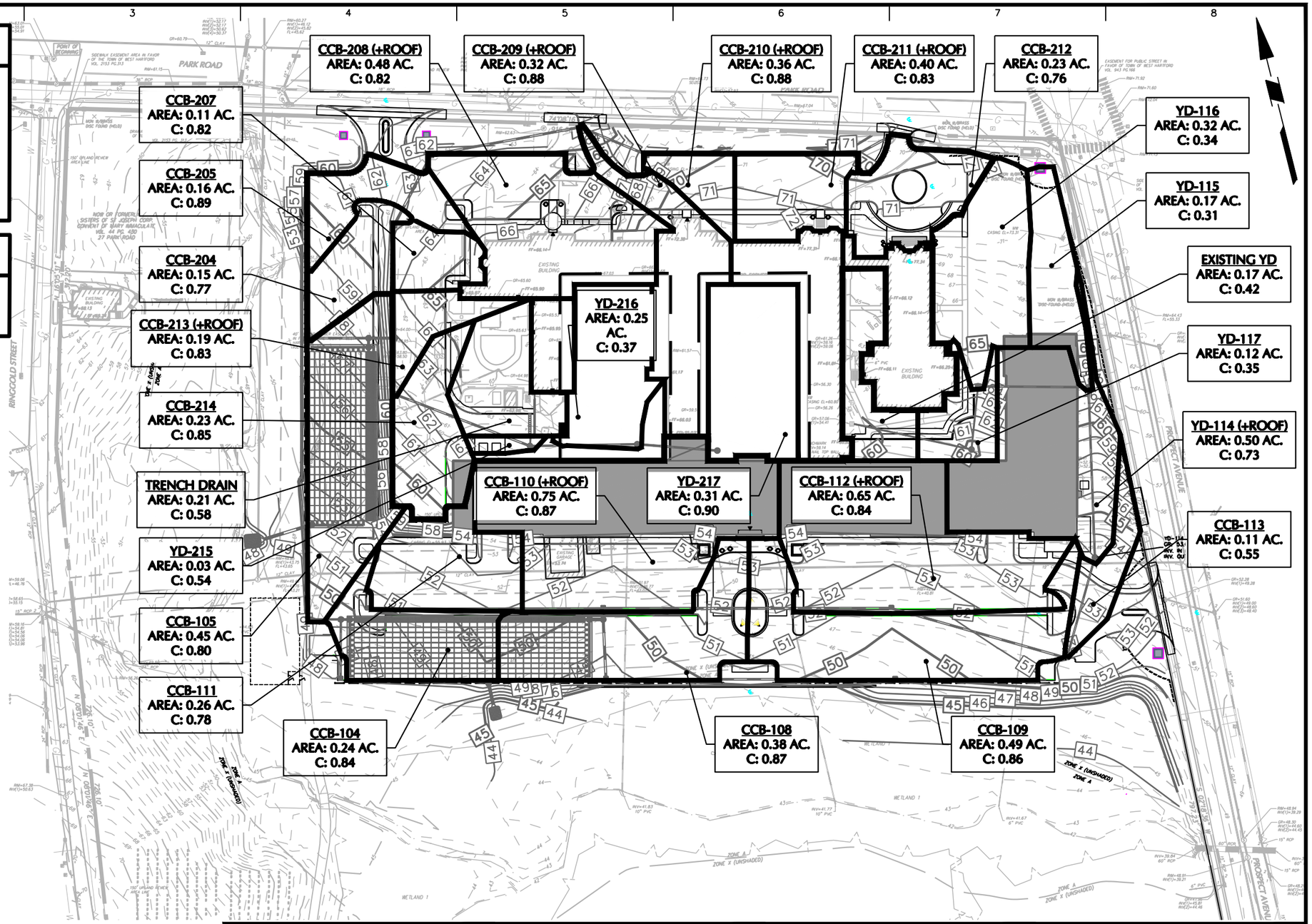
LEGEND

CATCHMENT AREAS



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Project	ONE PARK WEST HARTFORD CONNECTICUT
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Project No.	140184201
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Drawn By / Checked By	IV / NLK
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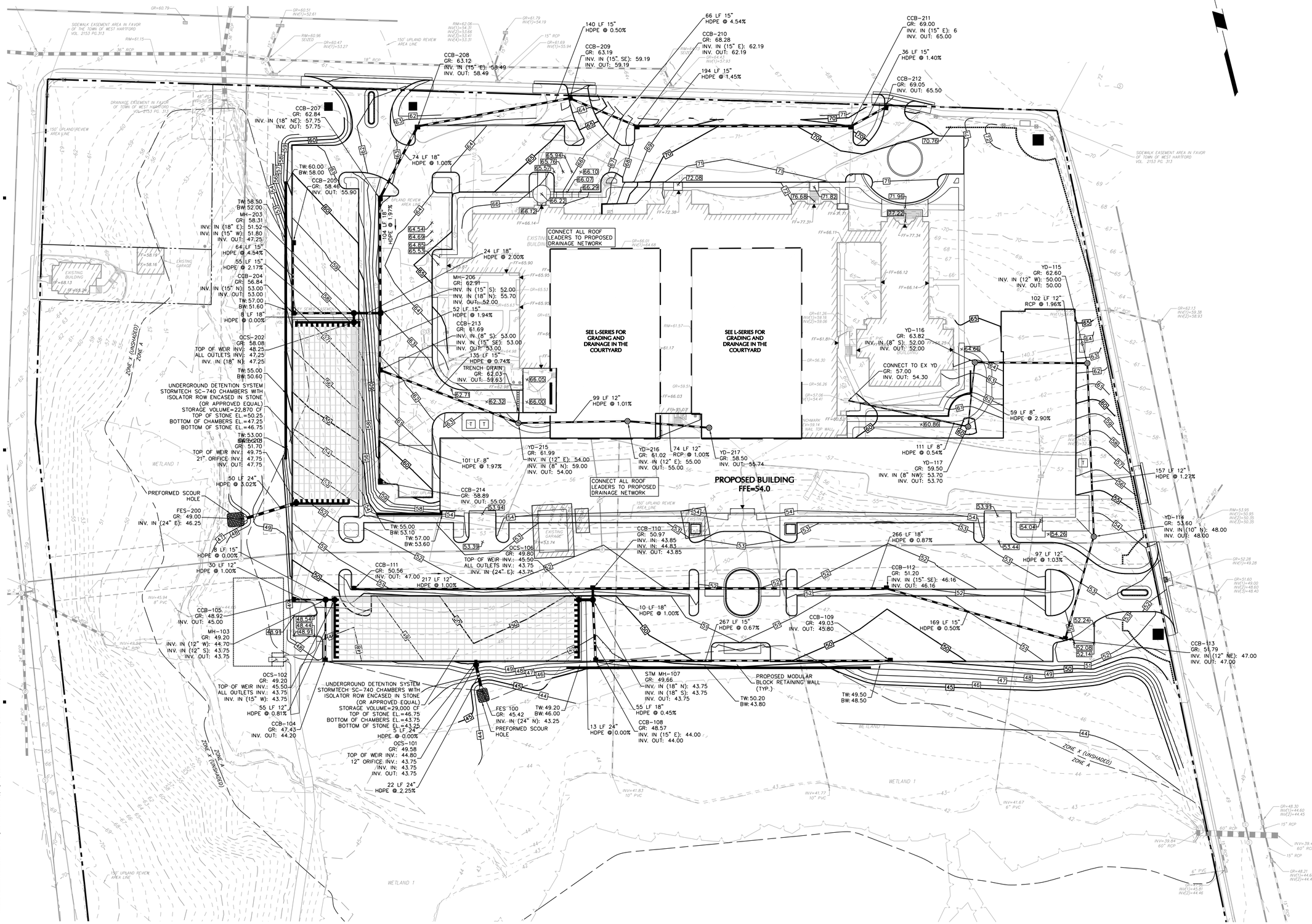

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ONE PARK ROAD

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PROJECT DATA

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CHECKED	NLK
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HISTORY OF SUBMISSIONS

No.	Date	Description
1	10/26/2018	Wetlands Application Submission
2	11/02/2018	Wetlands & SDD Application Submission

WETLANDS & SDD APPLICATION SUBMISSION

SHEET TITLE

GRADING AND DRAINAGE PLAN

CG101

APPENDIX A

Existing Stormwater Discharge Calculations

Project **ONE PARK ROAD** By **IV** Date **12/6/2018**

Location **1 PARK ROAD WEST HARTFORD, CT** Checked **NLK** Date **12/6/2018**

Circle one: (Present) Developed **EX-A**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Fig. 2-3	CN [1] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
B	**Impervious**	**98**			**2.43**	**238.14**
B	**Open Space, Good Cond.**	**61**			**3.33**	**203.13**
C	**Open Space, Good Cond.**	**74**			**4.67**	**345.58**
1 Use only one CN source per line				Totals =	**10.43**	**786.85**

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{786.85}{10.43} =$ 75.44 Use CN = **75**

2. Runoff

		Storm 1	Storm 2	Storm 3
Frequency	yr			
Rainfall, P (24-hour)	in			
S				
Runoff, Q	in			

(Use P and CN with Table 2-1, Fig. 2-1,

Project **ONE PARK ROAD** By **IV** Date **12/6/2018**

Location **1 PARK ROAD WEST HARTFORD, CT** Checked **NLK** Date **12/6/2018**

Circle one: (Present) Developed **EX-B**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Fig. 2-3	CN [1] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
B	**Impervious**	**98**			**0.52**	**50.96**
B	**Open Space, Good Cond.**	**61**			**0.73**	**44.53**
C	**Open Space, Good Cond.**	**74**			**0.03**	**2.22**
D	**Open Space, Fair Cond.**	**84**			**0.15**	**12.60**
1 Use only one CN source per line				Totals =	**1.43**	**110.31**

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{110.31}{1.43} =$ 77.14 Use CN = **77**

2. Runoff

		Storm 1	Storm 2	Storm 3
Frequency	yr			
Rainfall, P (24-hour)	in			
S				
Runoff, Q	in			

(Use P and CN with Table 2-1, Fig. 2-1,

Project **ONE PARK ROAD** By **IV** Date **12/6/2018**

Location **1 PARK ROAD WEST HARTFORD, CT** Checked **NLK** Date **12/6/2018**

Circle one: (Present) Developed **EX-C**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Fig. 2-3	CN [1] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
B	**Impervious**	**98**			**0.02**	**1.96**
B	**Open Space, Good Cond.**	**61**			**0.10**	**6.10**
D	**Open Space, Good Cond.**	**80**			**0.03**	**2.40**

1 Use only one CN source per line

Totals = **0.15** **10.46**

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{10.46}{0.15} =$ 69.73 Use CN = **70**

2. Runoff

		Storm 1	Storm 2	Storm 3
Frequency	yr			
Rainfall, P (24-hour)	in			
S				
Runoff, Q	in			

(Use P and CN with Table 2-1, Fig. 2-1,

Project **One Park** By **BP** Date **8/6/2018**

Location **West Hartford, CT** Checked **NLK** Date **8/6/2018**

Circle One: (Present) Developed

Circle One: (T_c) T_t through subarea **Existing Drainage Area A**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	AB	BC				
1. Surface description (table 3-1)			Short Grass Prairie	Short Grass Prairie				
2. Manning's roughness coeff., n (table 3-1)			0.15	0.15				
3. Flow Length, L (total L ≤ 300 ft)		ft	50	100				
4. Two-yr 24-hr rainfall, P_2		in	3.3	3.3				
5. Land slope, s		ft/ft	0.020	0.050				
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.092	+ 0.111	+	=	0.204	

Shallow concentrated flow		Segment ID	CD			
7. Surface description (paved or unpaved)			Unpaved			
8. Flow length, L		ft	130			
9. Watercourse slope, s		ft/ft	0.050			
10. Average velocity, V (figure 3-1)		ft/s	3.6			
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.010	+	=	0.010

Channel flow		Segment ID	DE			
12. Cross sectional flow area, a		ft^2				
13. Wetted perimeter, p_w		ft				
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft				
15. Channel slope, s		ft/ft	0.020			
16. Manning's roughness coeff., n						
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s	5.00			
18. Flow length, L		ft	200			
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.011	+	=	0.011
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)						0.225 hr

Use Tc= 13 min

Project **One Park** By **BP** Date **8/6/2018**

Location **West Hartford, CT** Checked **NLK** Date **8/6/2018**

Circle One: (Present) Developed

Circle One: (T_c) T_t through subarea **Existing Drainage Area B**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	AB		
1. Surface description (table 3-1)			Short Grass Prairie		
2. Manning's roughness coeff., n (table 3-1)			0.15		
3. Flow Length, L (total L ≤ 300 ft)		ft	75		
4. Two-yr 24-hr rainfall, P_2		in	3.3		
5. Land slope, s		ft/ft	0.013		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.152 +	+	= 0.152

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L		ft		
9. Watercourse slope, s		ft/ft		
10. Average velocity, V (figure 3-1)		ft/s		
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	+	= 0.000

Channel flow		Segment ID		
12. Cross sectional flow area, a		ft^2		
13. Wetted perimeter, p_w		ft		
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft		
15. Channel slope, s		ft/ft		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s		
18. Flow length, L		ft		
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	+	= 0.000
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)				0.152 hr

Use Tc= 9 min

Project **One Park** By **BP** Date **8/6/2018**

Location **West Hartford, CT** Checked **NLK** Date **8/6/2018**

Circle One: (Present) Developed

Circle One: (T_c) T_t through subarea **Existing Drainage Area C**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	AB		
1. Surface description (table 3-1)			Short Grass Prairie		
2. Manning's roughness coeff., n (table 3-1)			0.15		
3. Flow Length, L (total L ≤ 300 ft)		ft	100		
4. Two-yr 24-hr rainfall, P_2		in	3.3		
5. Land slope, s		ft/ft	0.083		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.091 +	+	= 0.091

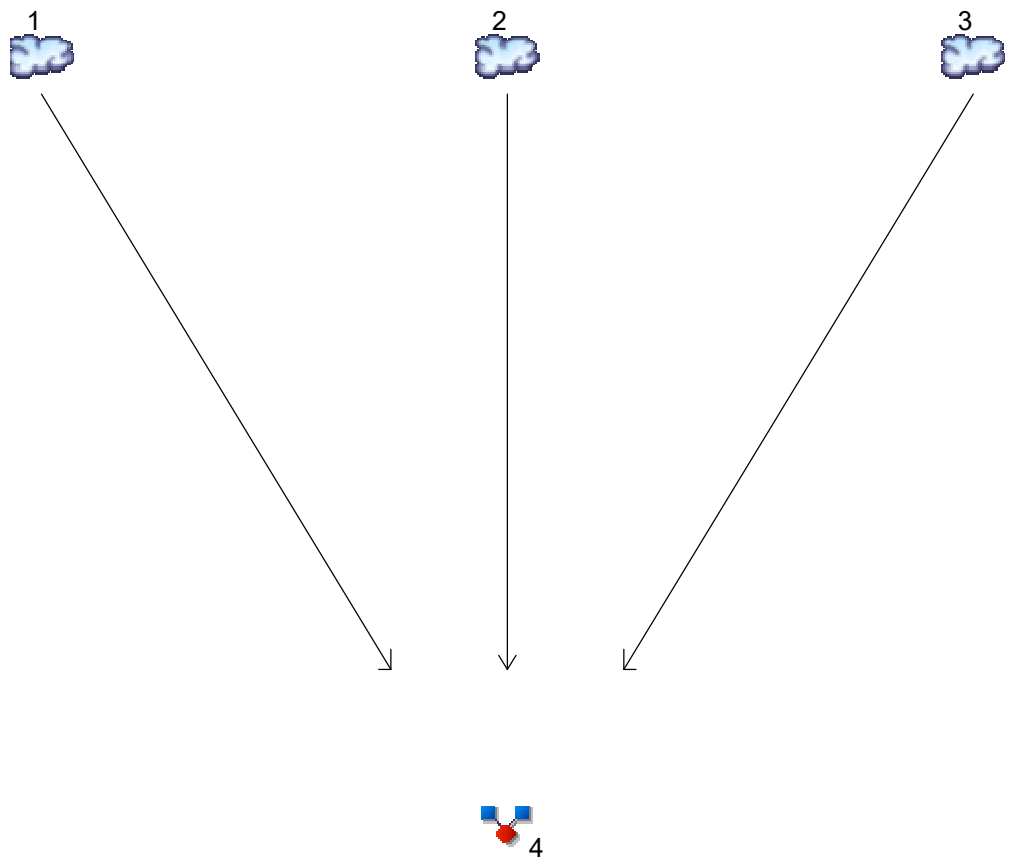
Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L		ft		
9. Watercourse slope, s		ft/ft		
10. Average velocity, V (figure 3-1)		ft/s		
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	+	= 0.000

Channel flow		Segment ID		
12. Cross sectional flow area, a		ft^2		
13. Wetted perimeter, p_w		ft		
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft		
15. Channel slope, s		ft/ft		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s		
18. Flow length, L		ft		
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	+	= 0.000
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)				0.091 hr

Use Tc= 5 min

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Legend

Hyd.	Origin	Description
1	SCS Runoff	Watershed A
2	SCS Runoff	Watershed B
3	SCS Runoff	Watershed C
4	Combine	Total Off-site

Hydrograph Return Period Recap

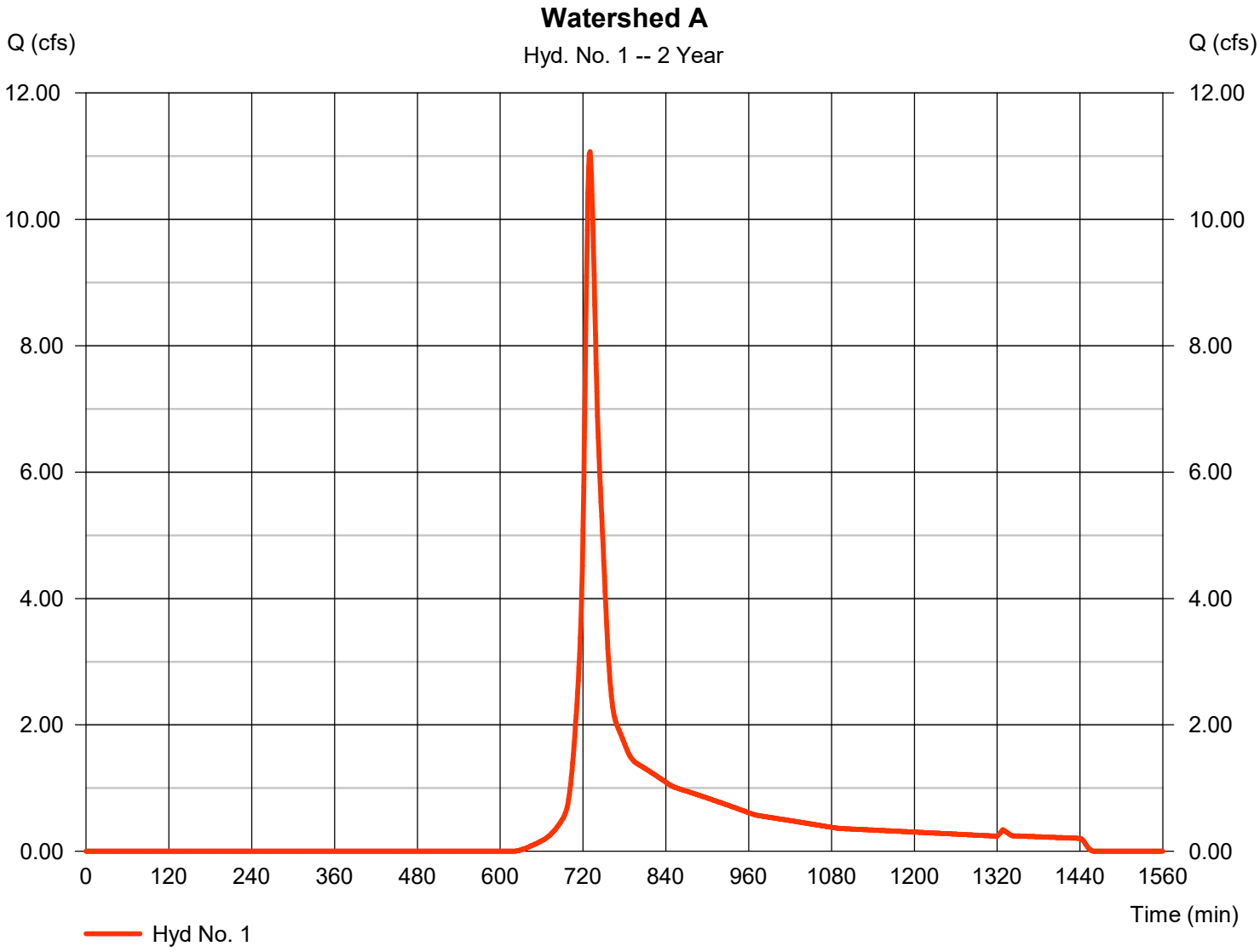
Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	11.07	-------	-------	26.67	37.15	-------	53.82	Watershed A
2	SCS Runoff	------	-------	1.901	-------	-------	4.362	5.983	-------	8.541	Watershed B
3	SCS Runoff	------	-------	0.147	-------	-------	0.408	0.590	-------	0.885	Watershed C
4	Combine	1, 2, 3	-------	12.99	-------	-------	31.13	43.26	-------	62.66	Total Off-site

Hydrograph Report

Hyd. No. 1

Watershed A

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.07 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	1 min	Hyd. volume	=	43,314 cuft
Drainage area	=	10.430 ac	Curve number	=	75
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.00 min
Total precip.	=	3.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

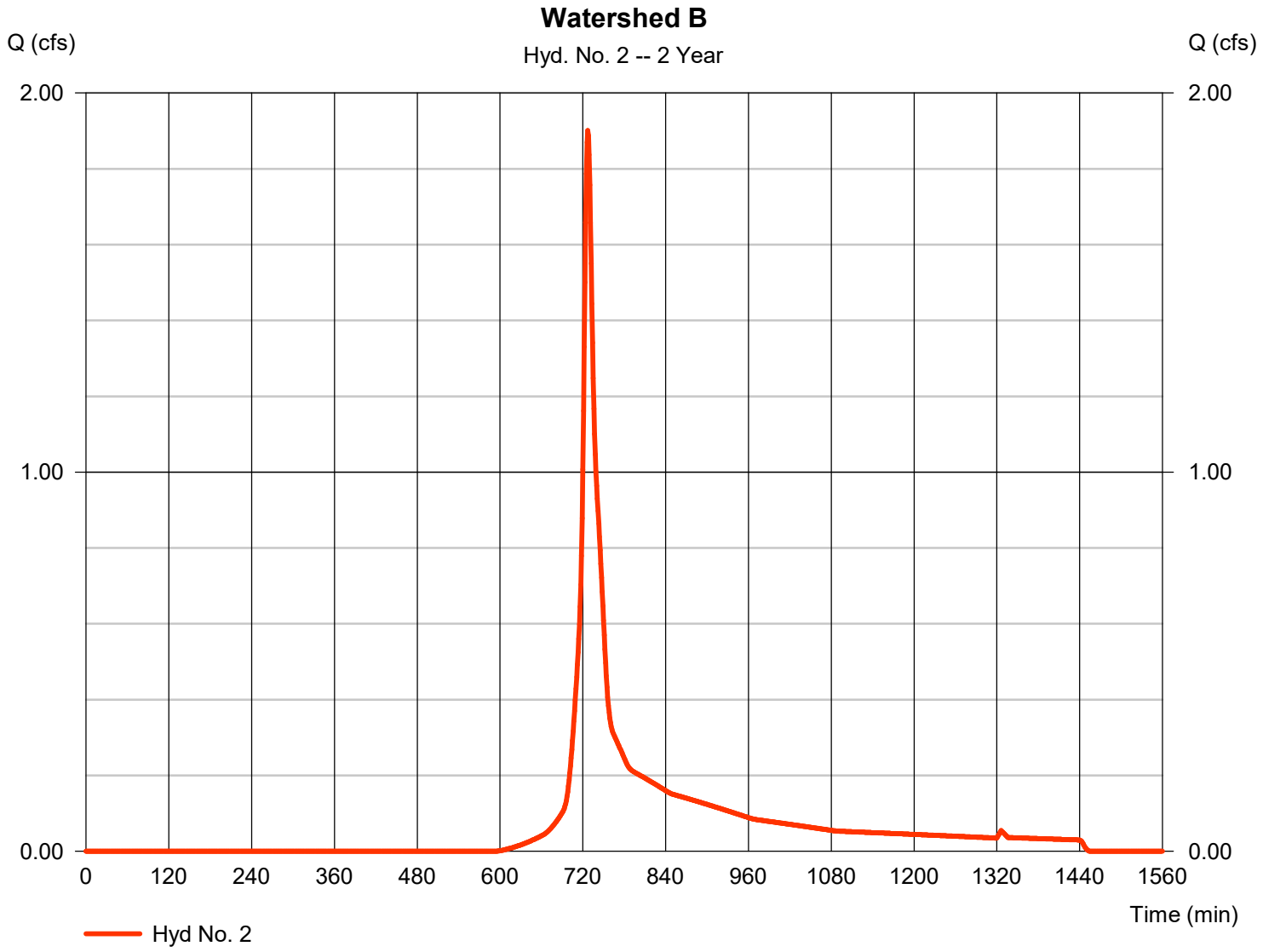


Hydrograph Report

Hyd. No. 2

Watershed B

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.901 cfs
Storm frequency	=	2 yrs	Time to peak	=	727 min
Time interval	=	1 min	Hyd. volume	=	6,664 cuft
Drainage area	=	1.430 ac	Curve number	=	77
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.00 min
Total precip.	=	3.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

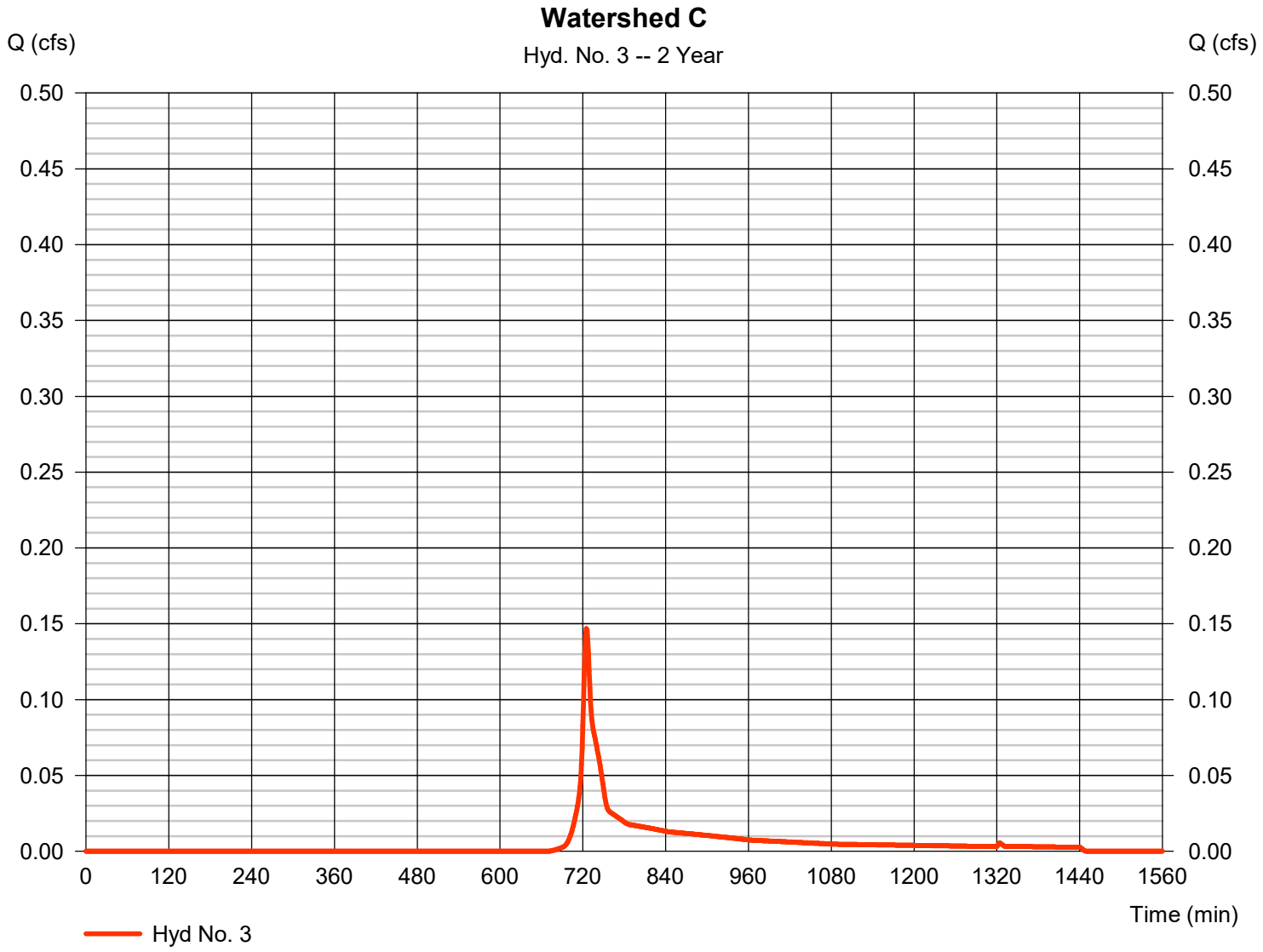


Hydrograph Report

Hyd. No. 3

Watershed C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.147 cfs
Storm frequency	= 2 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 498 cuft
Drainage area	= 0.150 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

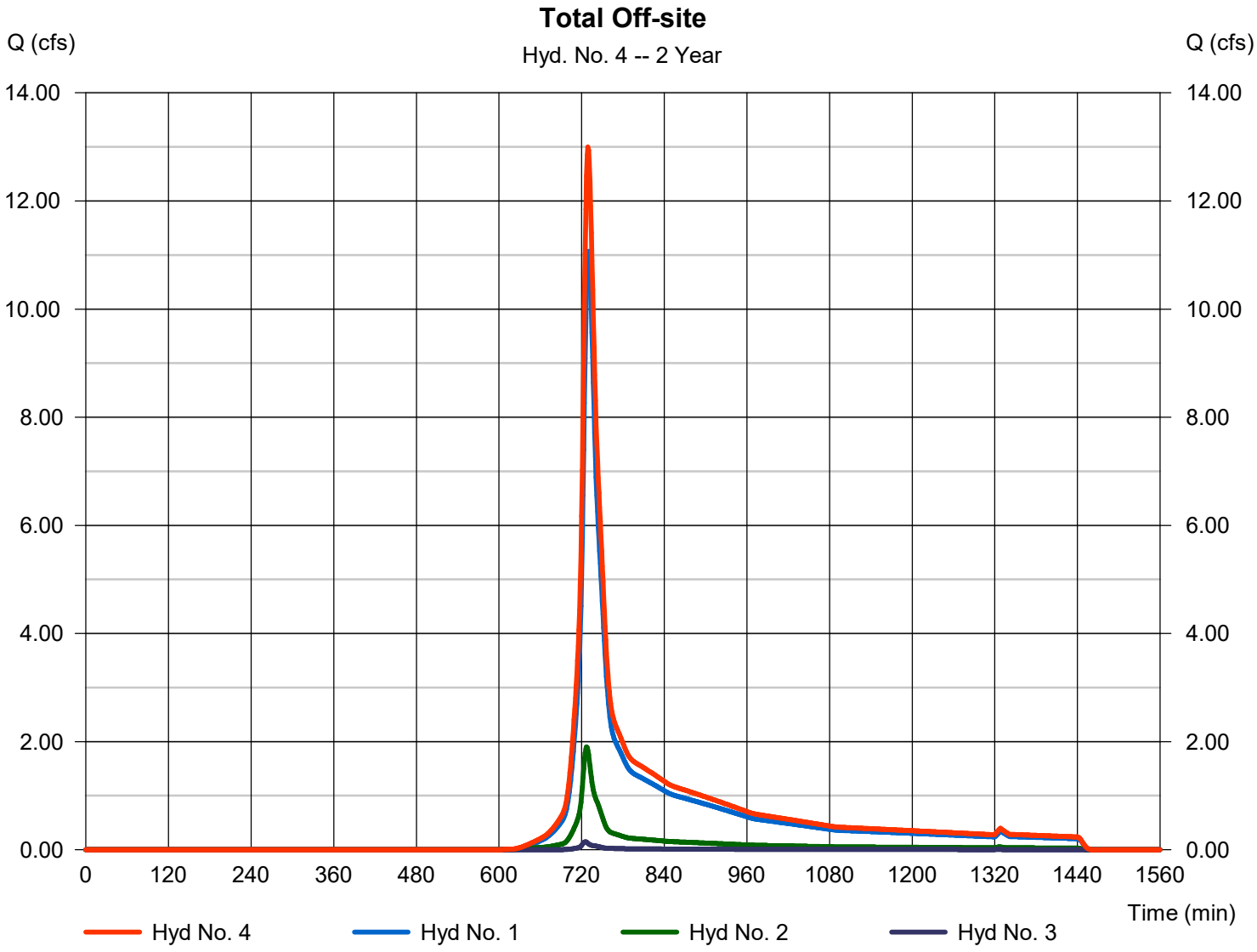


Hydrograph Report

Hyd. No. 4

Total Off-site

Hydrograph type	= Combine	Peak discharge	= 12.99 cfs
Storm frequency	= 2 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 50,476 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 12.010 ac

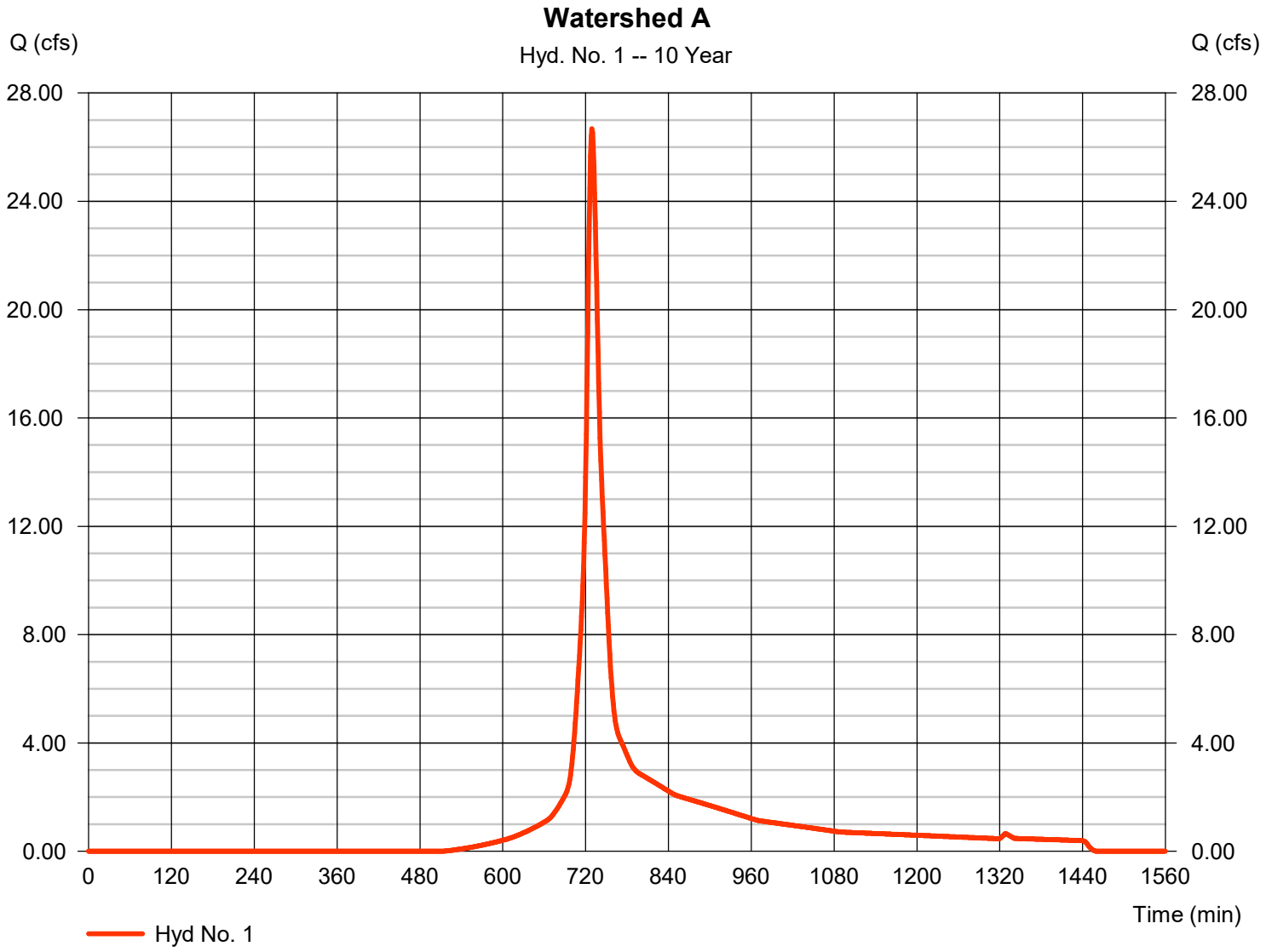


Hydrograph Report

Hyd. No. 1

Watershed A

Hydrograph type	= SCS Runoff	Peak discharge	= 26.67 cfs
Storm frequency	= 10 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 100,430 cuft
Drainage area	= 10.430 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

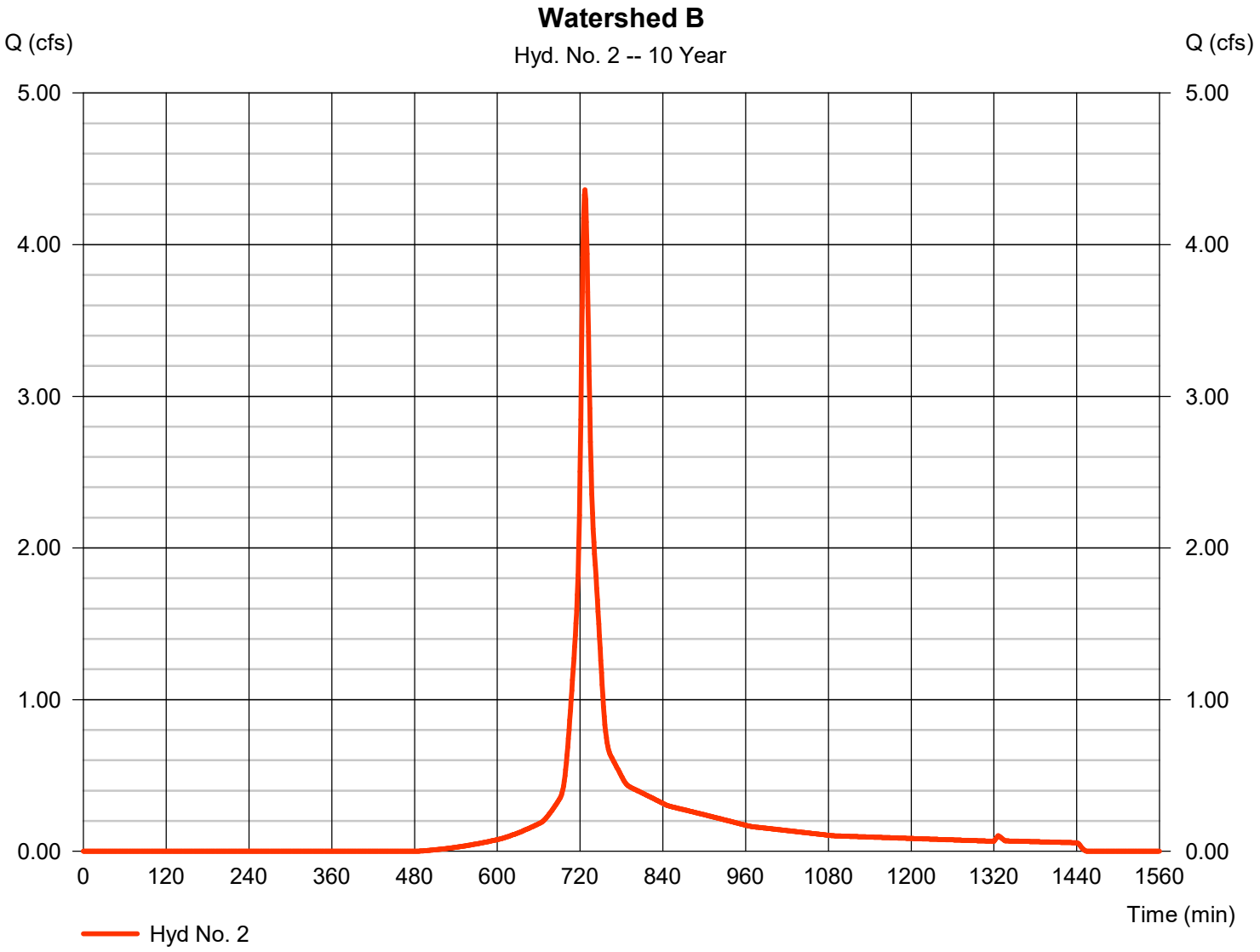


Hydrograph Report

Hyd. No. 2

Watershed B

Hydrograph type	= SCS Runoff	Peak discharge	= 4.362 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 14,928 cuft
Drainage area	= 1.430 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

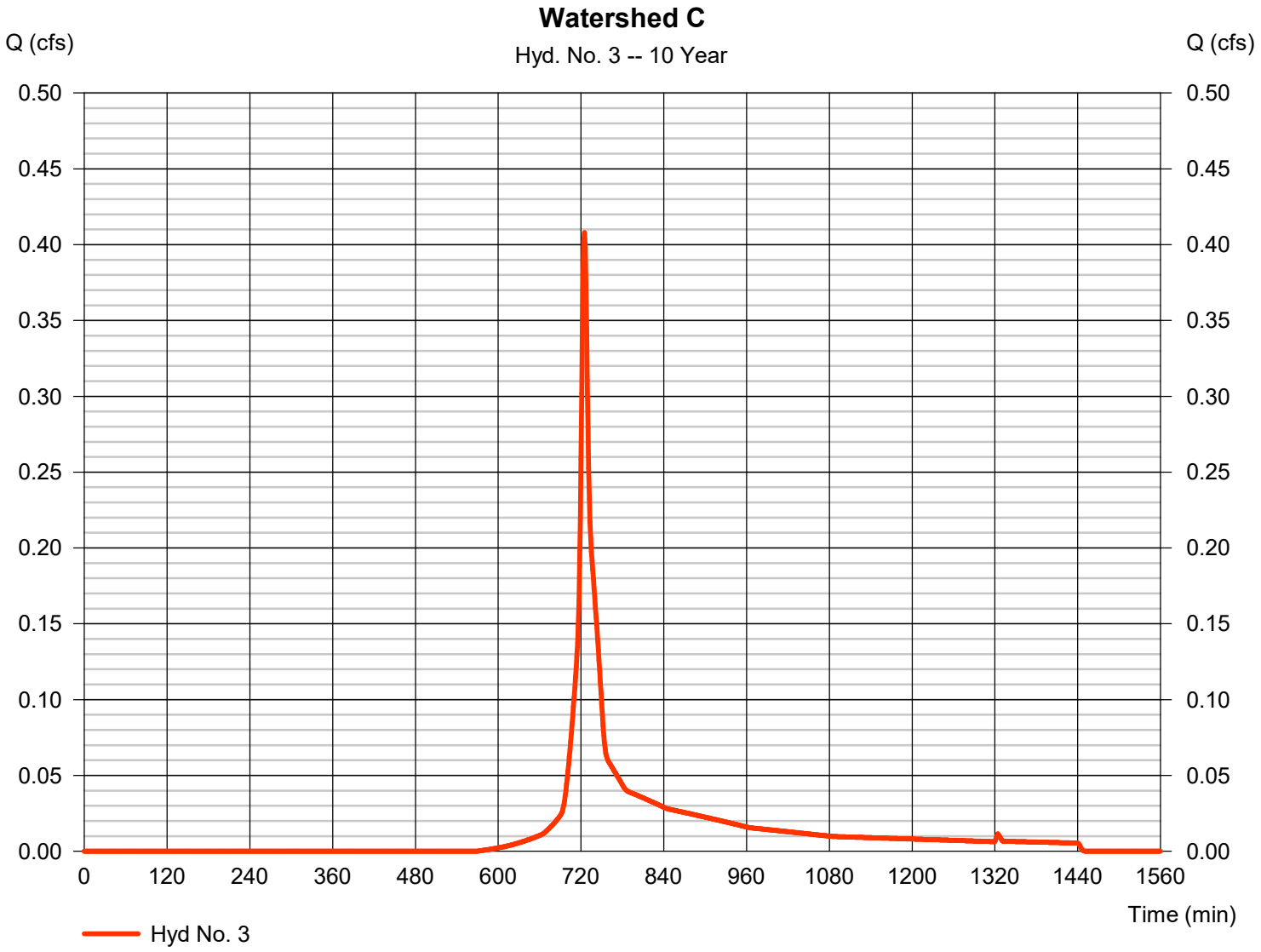


Hydrograph Report

Hyd. No. 3

Watershed C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.408 cfs
Storm frequency	=	10 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	1,270 cuft
Drainage area	=	0.150 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

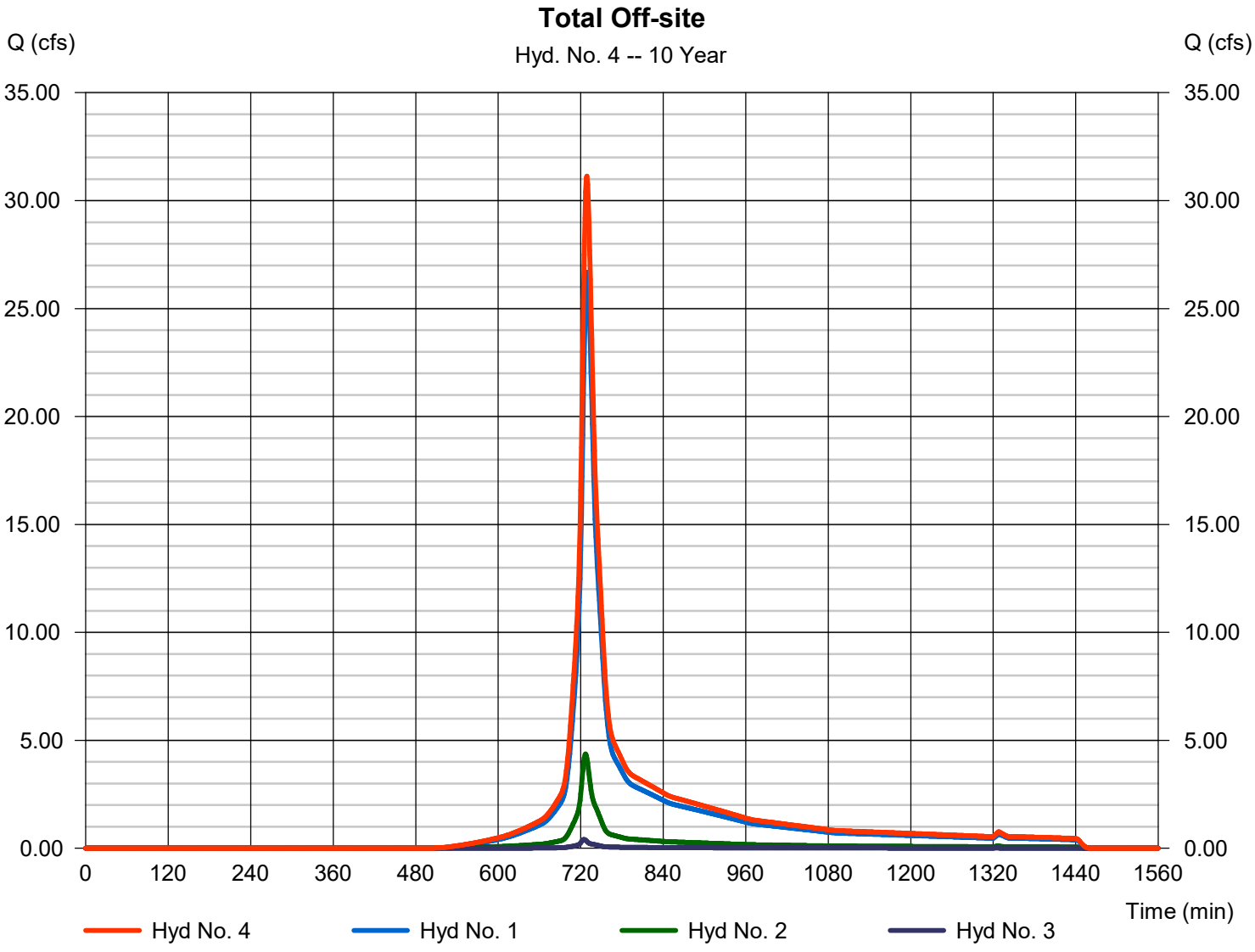


Hydrograph Report

Hyd. No. 4

Total Off-site

Hydrograph type	= Combine	Peak discharge	= 31.13 cfs
Storm frequency	= 10 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 116,628 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 12.010 ac

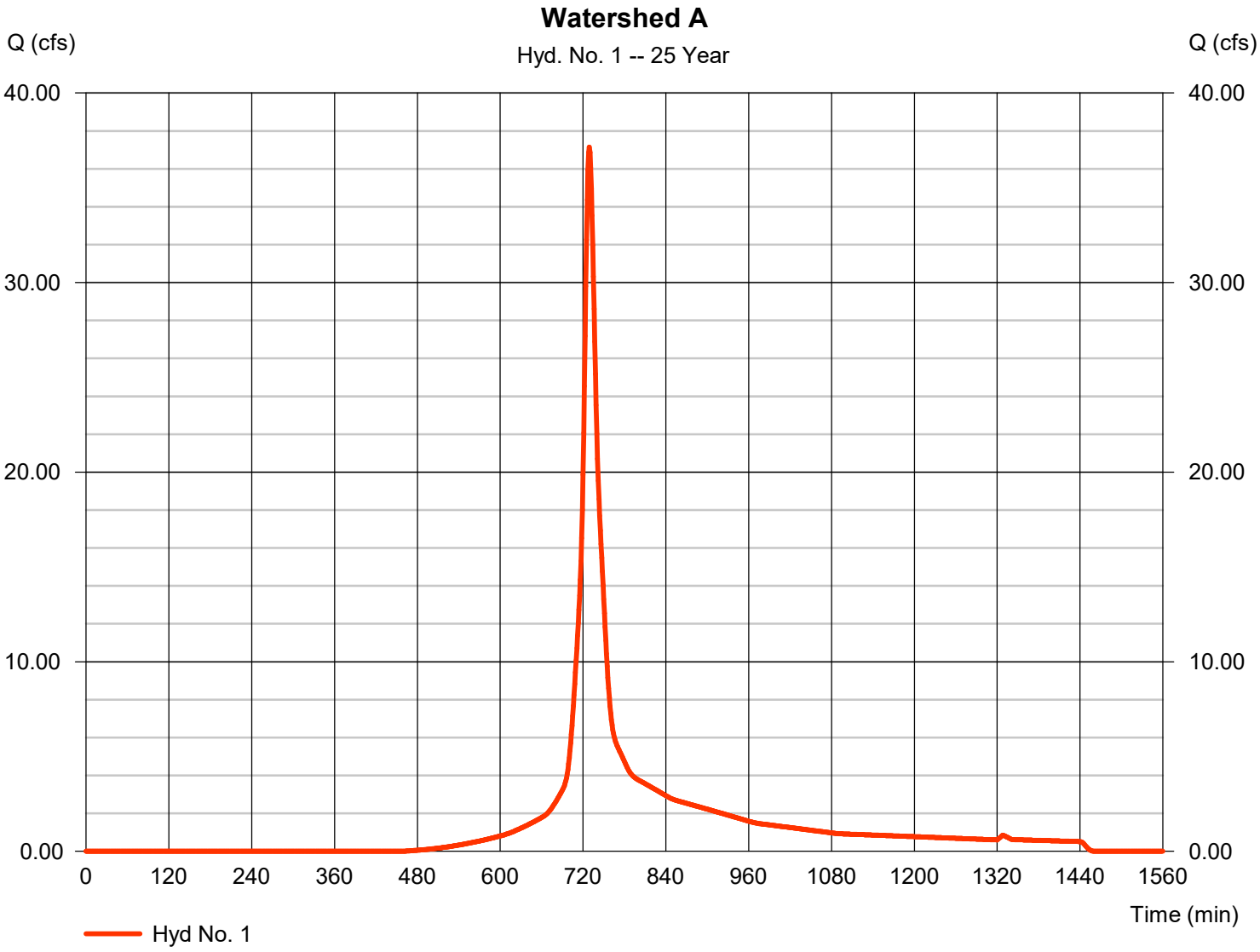


Hydrograph Report

Hyd. No. 1

Watershed A

Hydrograph type	=	SCS Runoff	Peak discharge	=	37.15 cfs
Storm frequency	=	25 yrs	Time to peak	=	729 min
Time interval	=	1 min	Hyd. volume	=	139,643 cuft
Drainage area	=	10.430 ac	Curve number	=	75
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.00 min
Total precip.	=	6.54 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

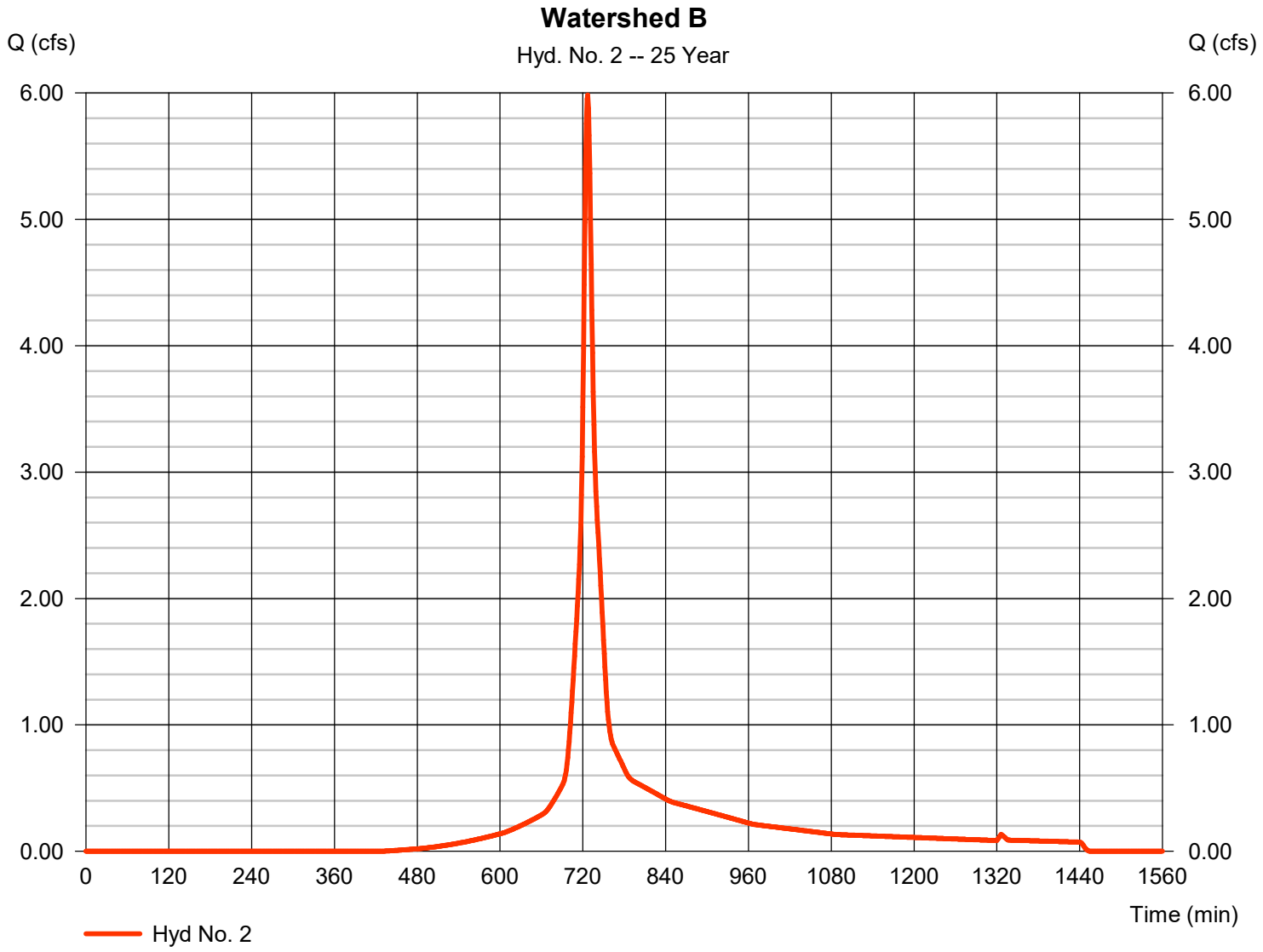


Hydrograph Report

Hyd. No. 2

Watershed B

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.983 cfs
Storm frequency	=	25 yrs	Time to peak	=	727 min
Time interval	=	1 min	Hyd. volume	=	20,529 cuft
Drainage area	=	1.430 ac	Curve number	=	77
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.00 min
Total precip.	=	6.54 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

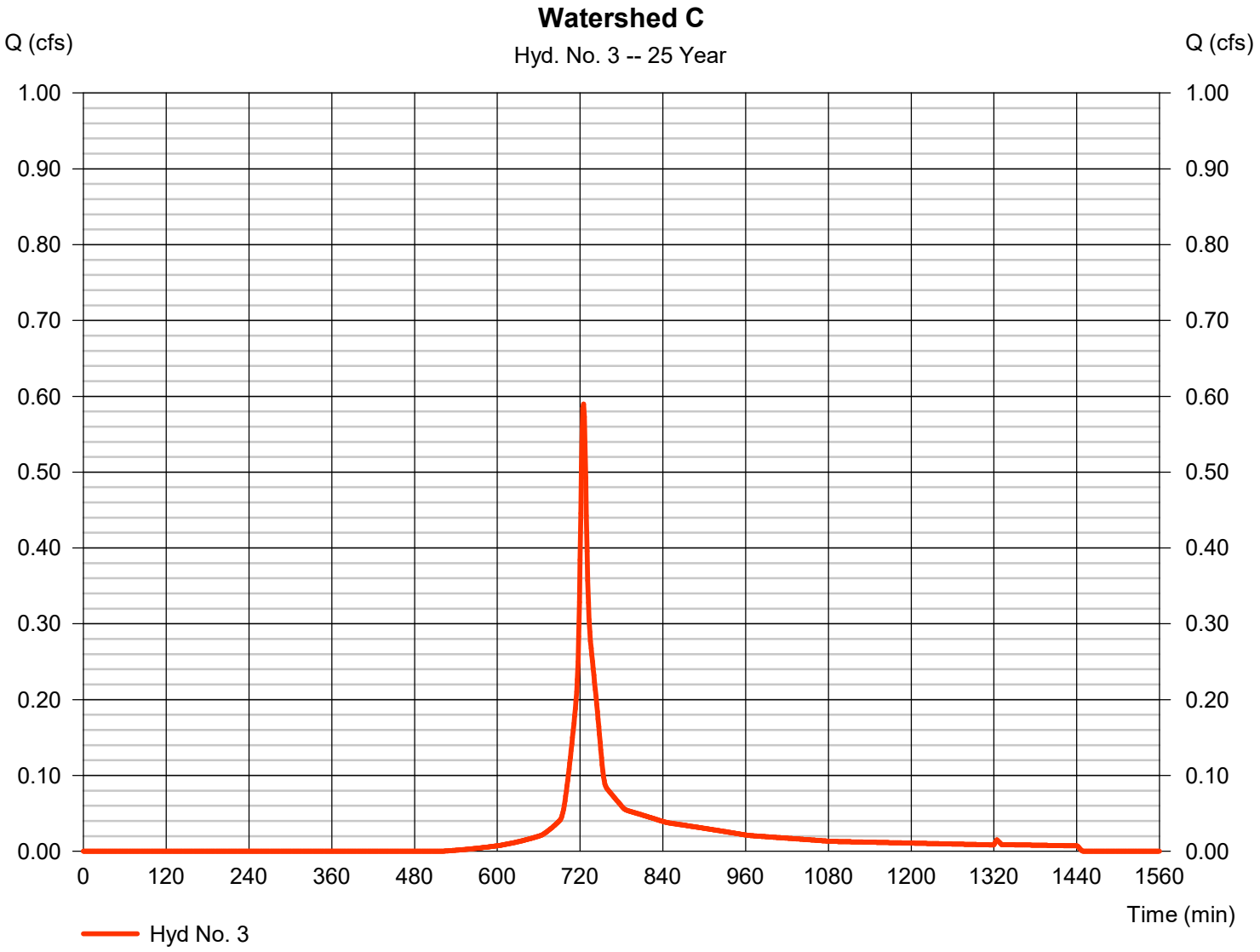


Hydrograph Report

Hyd. No. 3

Watershed C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.590 cfs
Storm frequency	=	25 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	1,819 cuft
Drainage area	=	0.150 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.54 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

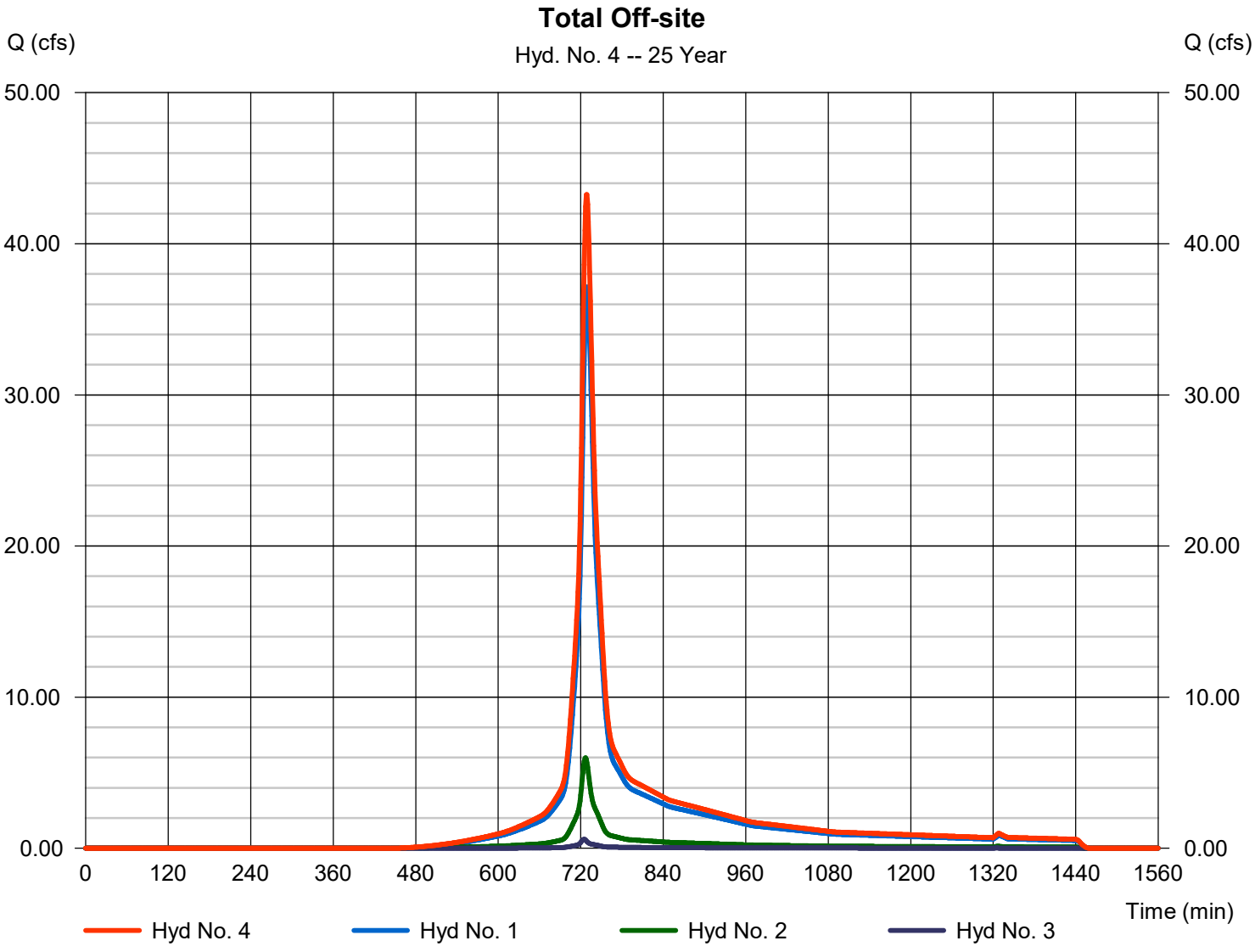


Hydrograph Report

Hyd. No. 4

Total Off-site

Hydrograph type	= Combine	Peak discharge	= 43.26 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 161,991 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 12.010 ac

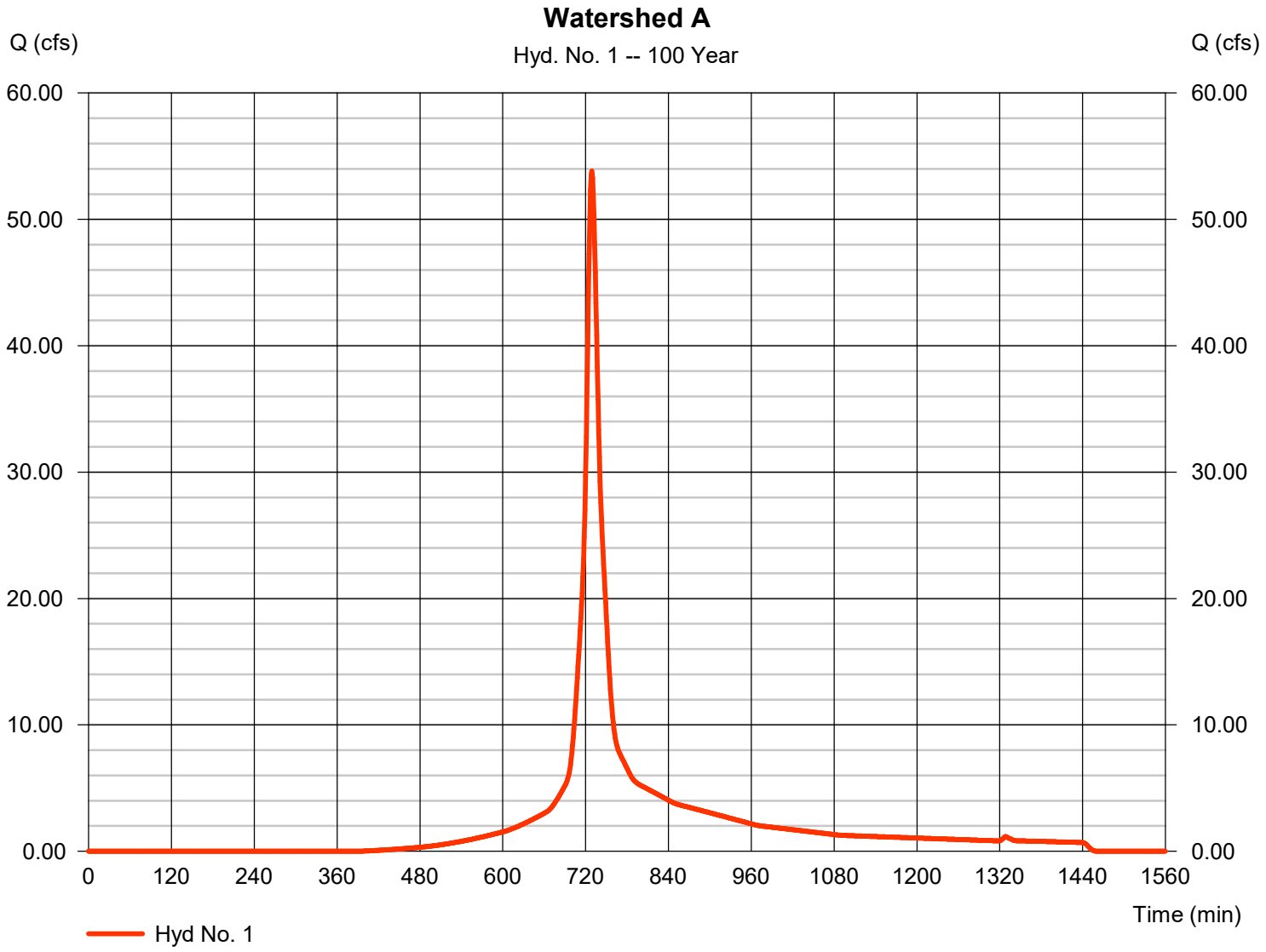


Hydrograph Report

Hyd. No. 1

Watershed A

Hydrograph type	= SCS Runoff	Peak discharge	= 53.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 203,438 cuft
Drainage area	= 10.430 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.00 min
Total precip.	= 8.46 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

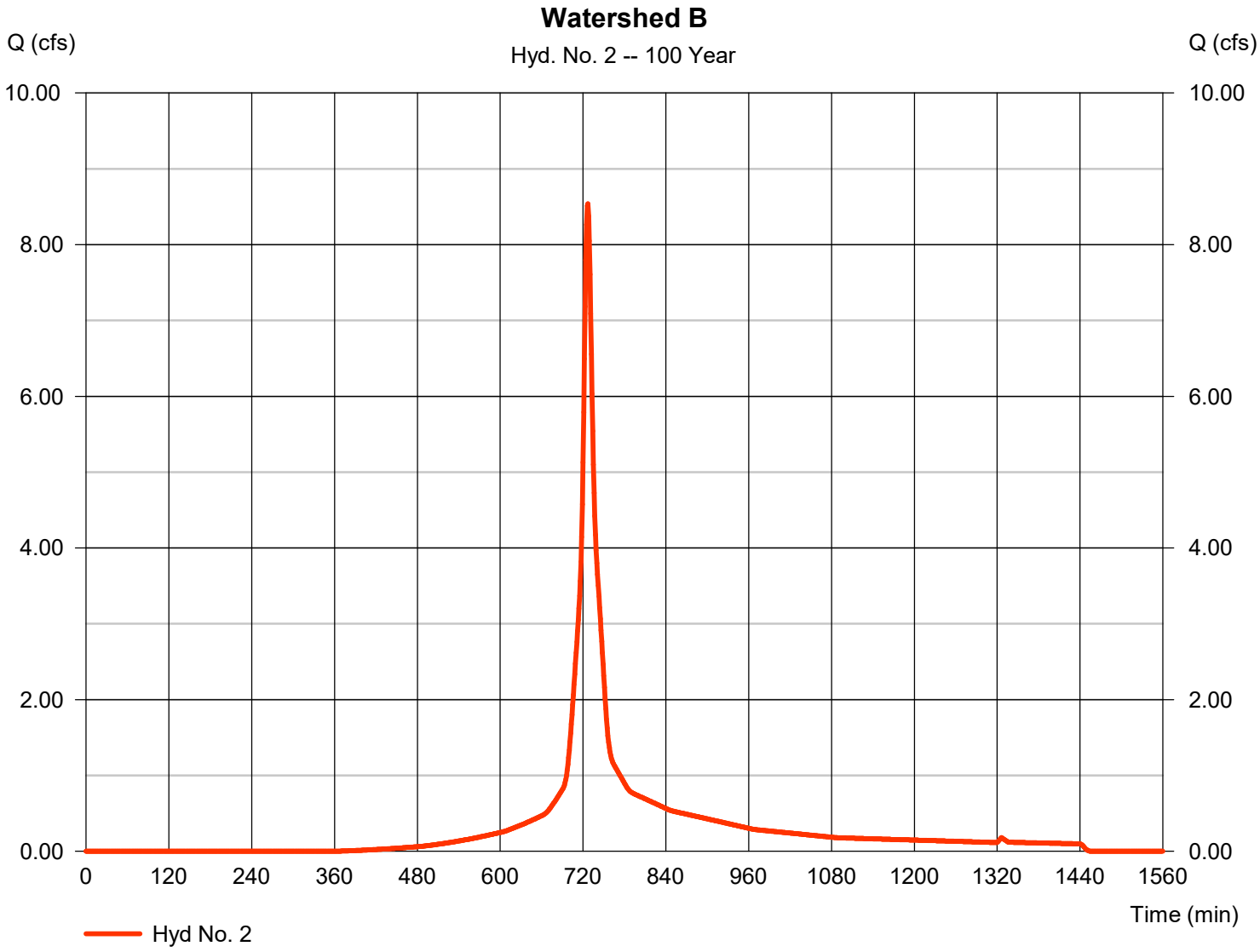


Hydrograph Report

Hyd. No. 2

Watershed B

Hydrograph type	= SCS Runoff	Peak discharge	= 8.541 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 29,577 cuft
Drainage area	= 1.430 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.00 min
Total precip.	= 8.46 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

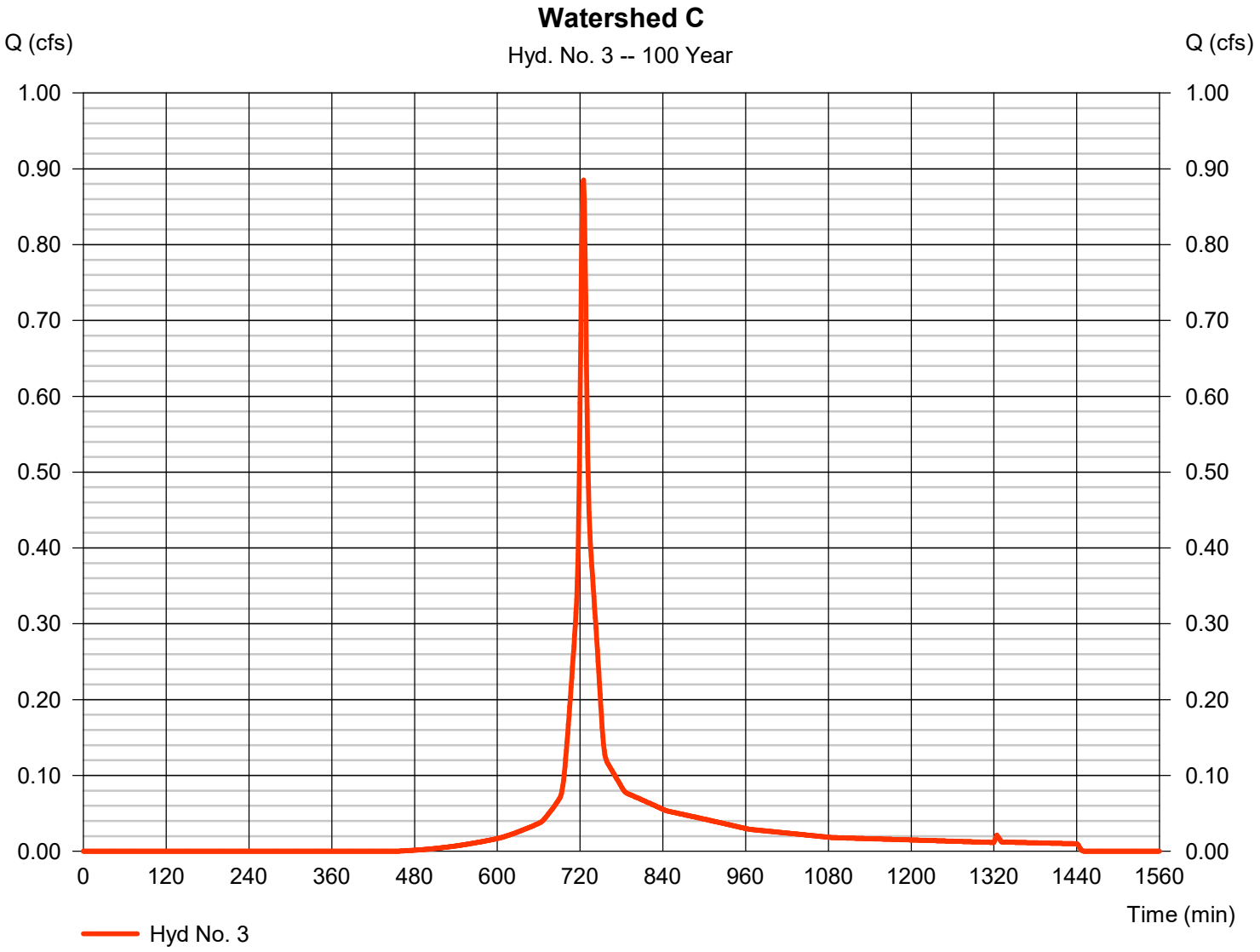


Hydrograph Report

Hyd. No. 3

Watershed C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.885 cfs
Storm frequency	=	100 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	2,730 cuft
Drainage area	=	0.150 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.46 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

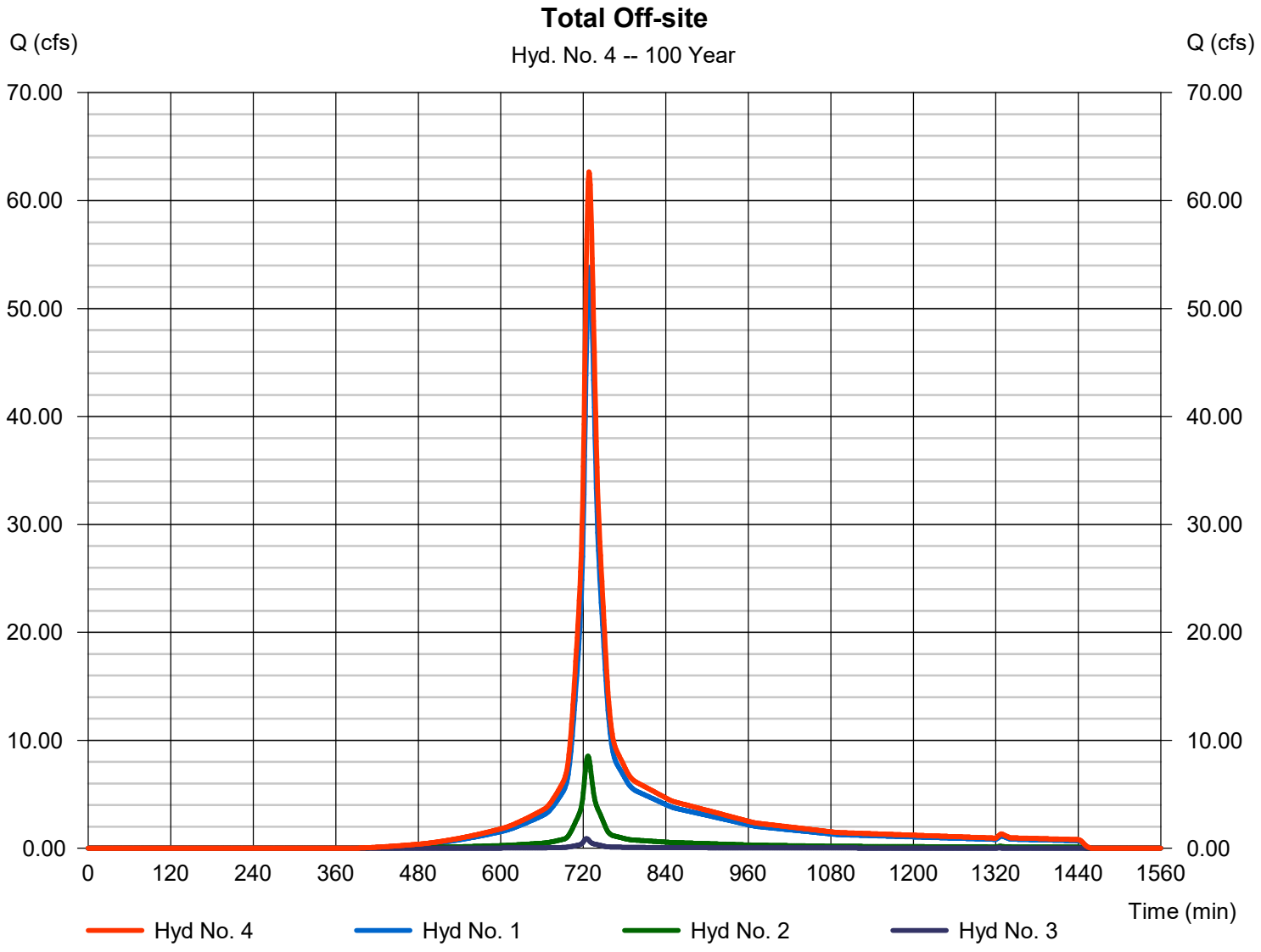


Hydrograph Report

Hyd. No. 4

Total Off-site

Hydrograph type	= Combine	Peak discharge	= 62.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 235,746 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 12.010 ac



APPENDIX B

Proposed Stormwater Discharge Calculations

Project **ONE PARK ROAD** By **RJS** Date **12/6/2018**

Location **1 PARK ROAD WEST HARTFORD, CT** Checked **NLK** Date **12/6/2018**

Circle one: Present (Developed) **PR-A1**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Fig. 2-3	CN [1] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
C	**Impervious**	**98**			**0.36**	**34.99**
C	**Open Space, Good Cond.**	**74**			**0.03**	**2.18**
B	**Impervious**	**98**			**2.11**	**206.61**
B	**Open Space, Good Cond.**	**61**			**0.94**	**57.06**
1 Use only one CN source per line				Totals =	**3.43**	**300.83**

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{300.83}{3.43} =$ 87.70 Use CN = **88**

2. Runoff

		Storm 1	Storm 2	Storm 3
Frequency	yr			
Rainfall, P (24-hour)	in			
S				
Runoff, Q	in			

(Use P and CN with Table 2-1, Fig. 2-1,

Project **ONE PARK ROAD** By **RJS** Date **12/6/2018**

Location **1 PARK ROAD WEST HARTFORD, CT** Checked **NLK** Date **12/6/2018**

Circle one: Present (Developed) **PR-A2**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Fig. 2-3	CN [1] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
B	**Impervious**	**98**			**2.23**	**218.92**
B	**Open Space, Good Cond.**	**61**			**1.01**	**61.85**
C	**Impervious**	**98**			**1.16**	**114.07**
C	**Open Space, Good Cond.**	**74**			**0.17**	**12.82**
D	**Open Space, Good Cond.**	**80**			**0.03**	**2.41**
1 Use only one CN source per line				Totals =	**4.62**	**410.08**

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{410.08}{4.62} =$ 88.85 Use CN = **89**

2. Runoff

		Storm 1	Storm 2	Storm 3
Frequency	yr			
Rainfall, P (24-hour)	in			
S				
Runoff, Q	in			

(Use P and CN with Table 2-1, Fig. 2-1,

Project **ONE PARK ROAD** By **RJS** Date **12/6/2018**

Location **1 PARK ROAD WEST HARTFORD, CT** Checked **NLK** Date **12/6/2018**

Circle one: Present (Developed) **PR-A3**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Fig. 2-3	CN [1] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
B	**Open Space, Good Cond.**	**61**			**0.76**	**46.59**
C	**Open Space, Good Cond.**	**74**			**2.77**	**205.22**
D	**Open Space, Good Cond.**	**80**			**0.03**	**2.61**
1 Use only one CN source per line				Totals =	**3.57**	**254.42**

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{254.42}{3.57} =$ 71.27 Use CN = **71**

2. Runoff

		Storm 1	Storm 2	Storm 3
Frequency	yr			
Rainfall, P (24-hour)	in			
S				
Runoff, Q	in			

(Use P and CN with Table 2-1, Fig. 2-1,

Project **ONE PARK ROAD** By **RJS** Date **12/6/2018**

Location **1 PARK ROAD WEST HARTFORD, CT** Checked **NLK** Date **12/6/2018**

Circle one: Present (Developed) **PR-B**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Fig. 2-3	CN [1] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
D	**Impervious**	**98**			**0.05**	**5.31**
D	**Open Space, Good Cond.**	**80**			**0.07**	**5.24**
B	**Impervious**	**98**			**0.03**	**2.86**
B	**Open Space, Good Cond.**	**61**			**0.23**	**14.16**
1 Use only one CN source per line				Totals =	**0.38**	**27.57**

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{27.57}{0.38} =$ 72.36 Use CN = **72**

2. Runoff

		Storm 1	Storm 2	Storm 3
Frequency	yr			
Rainfall, P (24-hour)	in			
S				
Runoff, Q	in			

(Use P and CN with Table 2-1, Fig. 2-1,

Project **ONE PARK ROAD** By **RJS** Date **12/6/2018**

Location **1 PARK ROAD WEST HARTFORD, CT** Checked **NLK** Date **12/6/2018**

Circle one: Present (Developed) **PR-C**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Fig. 2-3	CN [1] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
C	**Impervious**	**98**			**0.04**	**3.63**
C	**Open Space, Good Cond.**	**74**			**0.02**	**1.25**
D	**Impervious**	**98**			**0.01**	**0.76**
B	**Open Space, Good Cond.**	**61**			**0.05**	**2.99**
1 Use only one CN source per line				Totals =	**0.11**	**8.63**

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{8.63}{0.11} =$ 77.96 Use CN = **78**

2. Runoff

		Storm 1	Storm 2	Storm 3
Frequency	yr			
Rainfall, P (24-hour)	in			
S				
Runoff, Q	in			

(Use P and CN with Table 2-1, Fig. 2-1,

Project **One Park** By **IV** Date **10/23/2018**

Location **West Hartford, CT** Checked **NLK** Date **10/23/2018**

Circle One: Present (Developed)

Circle One: (T_c) T_t through subarea **Proposed Drainage Area A1**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	AB						
1. Surface description (table 3-1)			Short Grass Prairie						
2. Manning's roughness coeff., n (table 3-1)			0.15						
3. Flow Length, L (total L ≤ 300 ft)		ft	100						
4. Two-yr 24-hr rainfall, P_2		in	3.3						
5. Land slope, s		ft/ft	0.050						
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.111	+		+		=	0.111
Shallow concentrated flow		Segment ID							
7. Surface description (paved or unpaved)									
8. Flow length, L		ft							
9. Watercourse slope, s		ft/ft							
10. Average velocity, V (figure 3-1)		ft/s							
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=	0.000		
Channel flow		Segment ID	BC						
12. Cross sectional flow area, a		ft^2							
13. Wetted perimeter, p_w		ft							
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft							
15. Channel slope, s		ft/ft	0.030						
16. Manning's roughness coeff., n									
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s	5.00						
18. Flow length, L		ft	400						
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.022	+		=	0.022		
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)							0.134	hr	

Use Tc= 8 min

Project **One Park** By **IV** Date **10/23/2018**

Location **West Hartford, CT** Checked **NLK** Date **10/23/2018**

Circle One: Present (Developed)

Circle One: (T_c) T_t through subarea **Proposed Drainage Area A2**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	AB					
1. Surface description (table 3-1)			Short Grass Prairie					
2. Manning's roughness coeff., n (table 3-1)			0.15					
3. Flow Length, L (total L ≤ 300 ft)		ft	150					
4. Two-yr 24-hr rainfall, P_2		in	3.3					
5. Land slope, s		ft/ft	0.050	#DIV/0!				
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.154	+		+	=	0.154

Shallow concentrated flow		Segment ID						
7. Surface description (paved or unpaved)								
8. Flow length, L		ft						
9. Watercourse slope, s		ft/ft						
10. Average velocity, V (figure 3-1)		ft/s						
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=	0.000	

Channel flow		Segment ID	BC					
12. Cross sectional flow area, a		ft^2						
13. Wetted perimeter, p_w		ft						
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft						
15. Channel slope, s		ft/ft	0.020					
16. Manning's roughness coeff., n								
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s	5.00					
18. Flow length, L		ft	750					
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.042	+		=	0.042	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)							0.196	hr

Use Tc= 12 min

Project **One Park** By **IV** Date **10/23/2018**

Location **West Hartford, CT** Checked **NLK** Date **10/23/2018**

Circle One: Present (Developed)

Circle One: (T_c) T_t through subarea **Proposed Drainage Area A3**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	AB						
1. Surface description (table 3-1)			Short Grass Prairie						
2. Manning's roughness coeff., n (table 3-1)			0.15						
3. Flow Length, L (total L ≤ 300 ft)		ft	130						
4. Two-yr 24-hr rainfall, P_2		in	3.3						
5. Land slope, s		ft/ft	0.030						
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.169	+		+		=	0.169

Shallow concentrated flow		Segment ID							
7. Surface description (paved or unpaved)									
8. Flow length, L		ft							
9. Watercourse slope, s		ft/ft							
10. Average velocity, V (figure 3-1)		ft/s							
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=	0.000		

Channel flow		Segment ID							
12. Cross sectional flow area, a		ft^2							
13. Wetted perimeter, p_w		ft							
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft							
15. Channel slope, s		ft/ft							
16. Manning's roughness coeff., n									
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s							
18. Flow length, L		ft							
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=	0.000		
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)							0.169	hr	

Use Tc= 10 min

Project **One Park** By **IV** Date **10/23/2018**

Location **West Hartford, CT** Checked **NLK** Date **10/23/2018**

Circle One: Present (Developed)

Circle One: (T_c) T_t through subarea **Proposed Drainage Area B**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	AB	BC				
1. Surface description (table 3-1)			Short Grass Prairie	Short Grass Prairie				
2. Manning's roughness coeff., n (table 3-1)			0.15	0.15				
3. Flow Length, L (total L ≤ 300 ft)		ft	15	36				
4. Two-yr 24-hr rainfall, P_2		in	3.3	3.3				
5. Land slope, s		ft/ft	0.069	0.113				
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.021	+ 0.035	+	=	0.056	

Shallow concentrated flow		Segment ID						
7. Surface description (paved or unpaved)								
8. Flow length, L		ft						
9. Watercourse slope, s		ft/ft						
10. Average velocity, V (figure 3-1)		ft/s						
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=	0.000	

Channel flow		Segment ID						
12. Cross sectional flow area, a		ft^2						
13. Wetted perimeter, p_w		ft						
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft						
15. Channel slope, s		ft/ft						
16. Manning's roughness coeff., n								
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s						
18. Flow length, L		ft						
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=	0.000	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)							0.056	hr

Use Tc= 5 min

Project **One Park** By **IV** Date **10/23/2018**

Location **West Hartford, CT** Checked **NLK** Date **10/23/2018**

Circle One: Present (Developed)

Circle One: (T_c) T_t through subarea **Proposed Drainage Area C**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	AB		
1. Surface description (table 3-1)			Short Grass Prairie		
2. Manning's roughness coeff., n (table 3-1)			0.15		
3. Flow Length, L (total L ≤ 300 ft)		ft	91		
4. Two-yr 24-hr rainfall, P_2		in	3.3		
5. Land slope, s		ft/ft	0.066		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.093 +	+	= 0.093

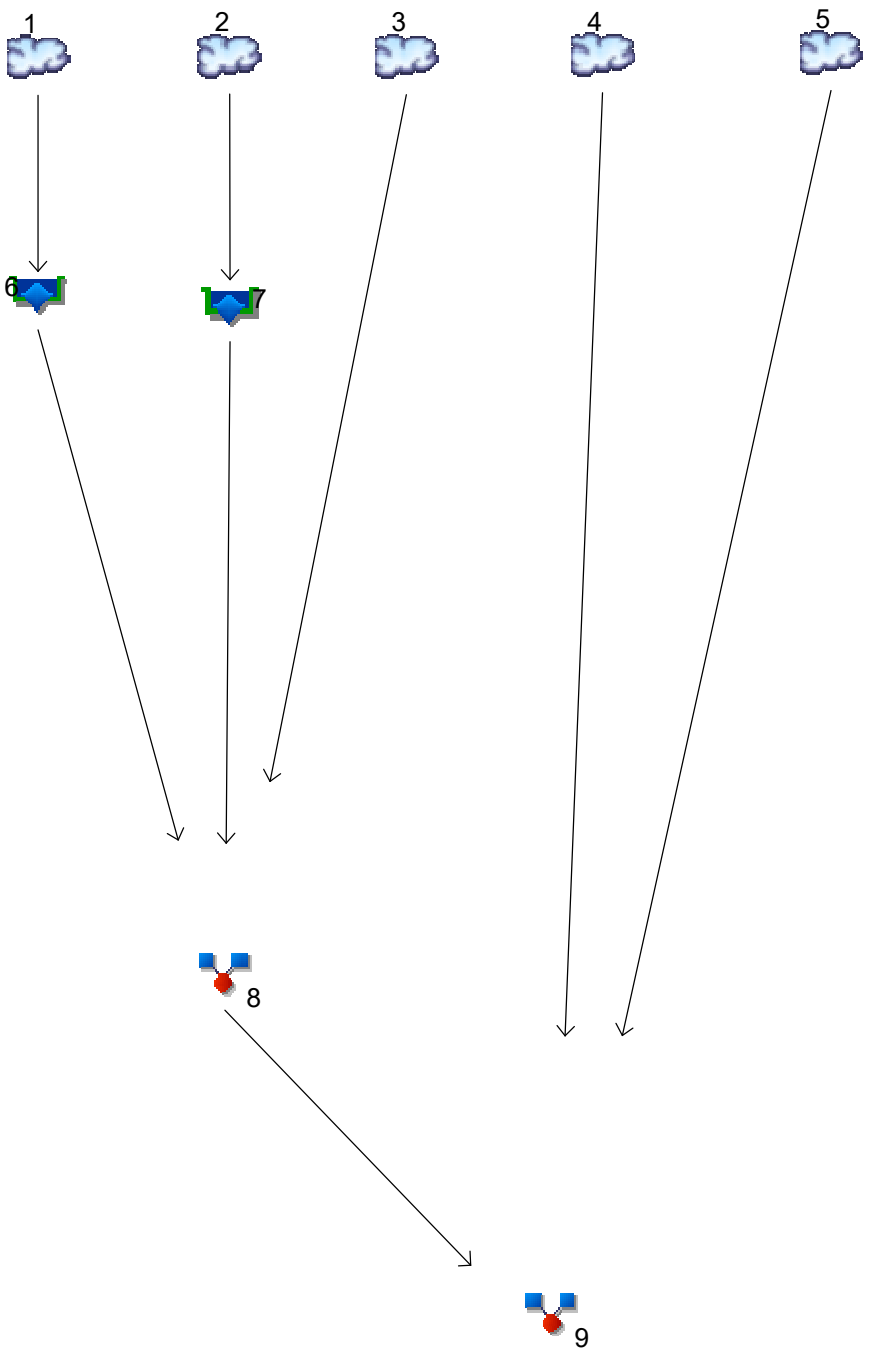
Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L		ft		
9. Watercourse slope, s		ft/ft		
10. Average velocity, V (figure 3-1)		ft/s		
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	+	= 0.000

Channel flow		Segment ID		
12. Cross sectional flow area, a		ft^2		
13. Wetted perimeter, p_w		ft		
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft		
15. Channel slope, s		ft/ft		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s		
18. Flow length, L		ft		
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	+	= 0.000
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)				0.093 hr

Use Tc= 6 min

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Legend

Hyd.	Origin	Description
1	SCS Runoff	WS PR-A1
2	SCS Runoff	WS PR-A2
3	SCS Runoff	WS PR-A3
4	SCS Runoff	WS PR-B
5	SCS Runoff	WS PR-C
6	Reservoir	DetentionA1
7	Reservoir	Detention A2
8	Combine	To Wetland
9	Combine	Total Site

Hydrograph Return Period Recap

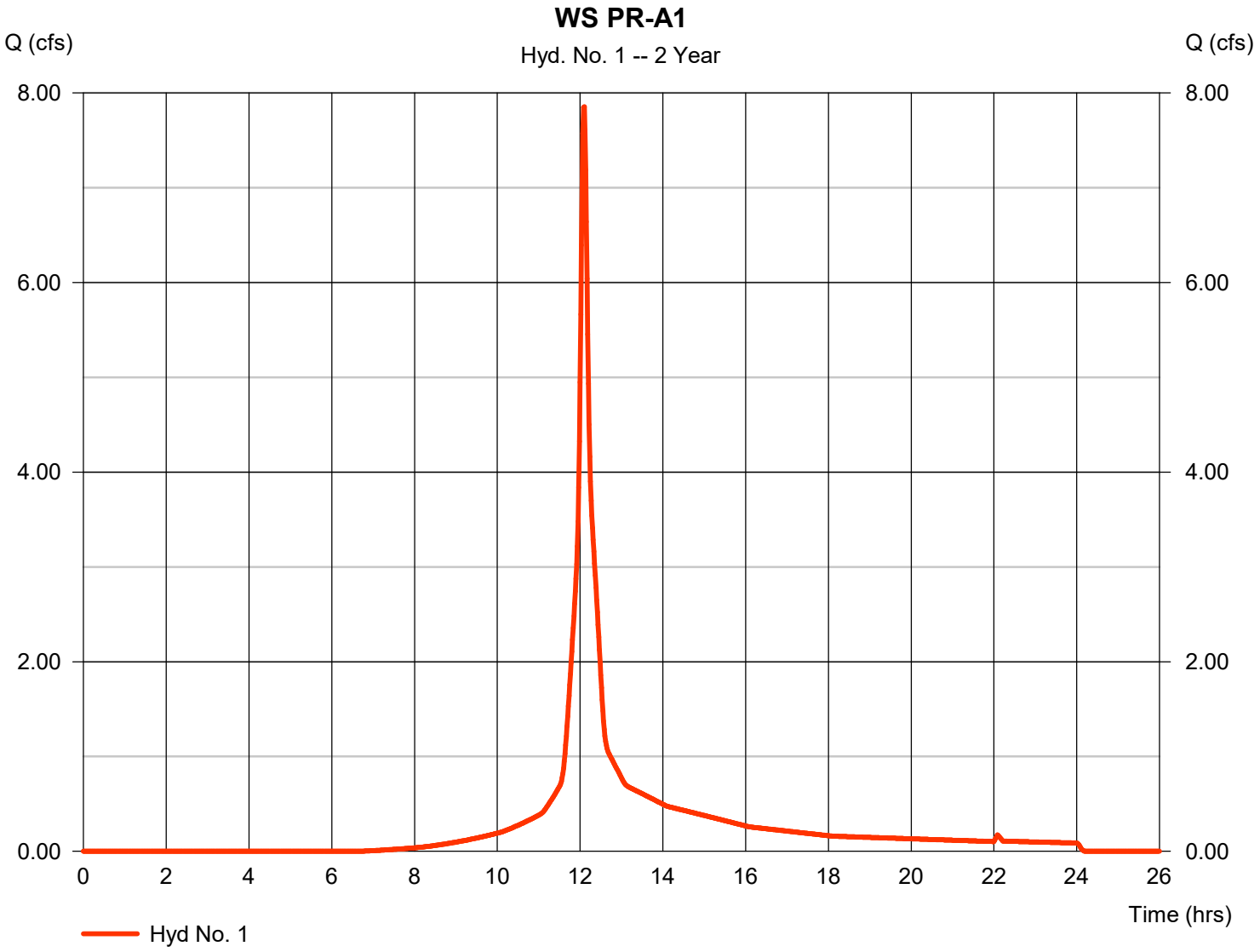
Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	7.854	-------	-------	14.56	18.71	-------	25.08	WS PR-A1
2	SCS Runoff	------	-------	9.473	-------	-------	17.26	22.06	-------	29.43	WS PR-A2
3	SCS Runoff	------	-------	3.164	-------	-------	8.527	12.24	-------	18.26	WS PR-A3
4	SCS Runoff	------	-------	0.429	-------	-------	1.117	1.589	-------	2.347	WS PR-B
5	SCS Runoff	------	-------	0.177	-------	-------	0.397	0.540	-------	0.765	WS PR-C
6	Reservoir	1	-------	2.464	-------	-------	8.807	12.35	-------	17.02	DetentionA1
7	Reservoir	2	-------	3.655	-------	-------	11.52	14.58	-------	20.70	Detention A2
8	Combine	3, 6, 7	-------	7.551	-------	-------	25.98	36.12	-------	51.54	To Wetland
9	Combine	4, 5, 8	-------	7.777	-------	-------	26.85	37.53	-------	53.57	Total Site

Hydrograph Report

Hyd. No. 1

WS PR-A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.854 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	1 min	Hyd. volume	=	25,411 cuft
Drainage area	=	3.440 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	8.00 min
Total precip.	=	3.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

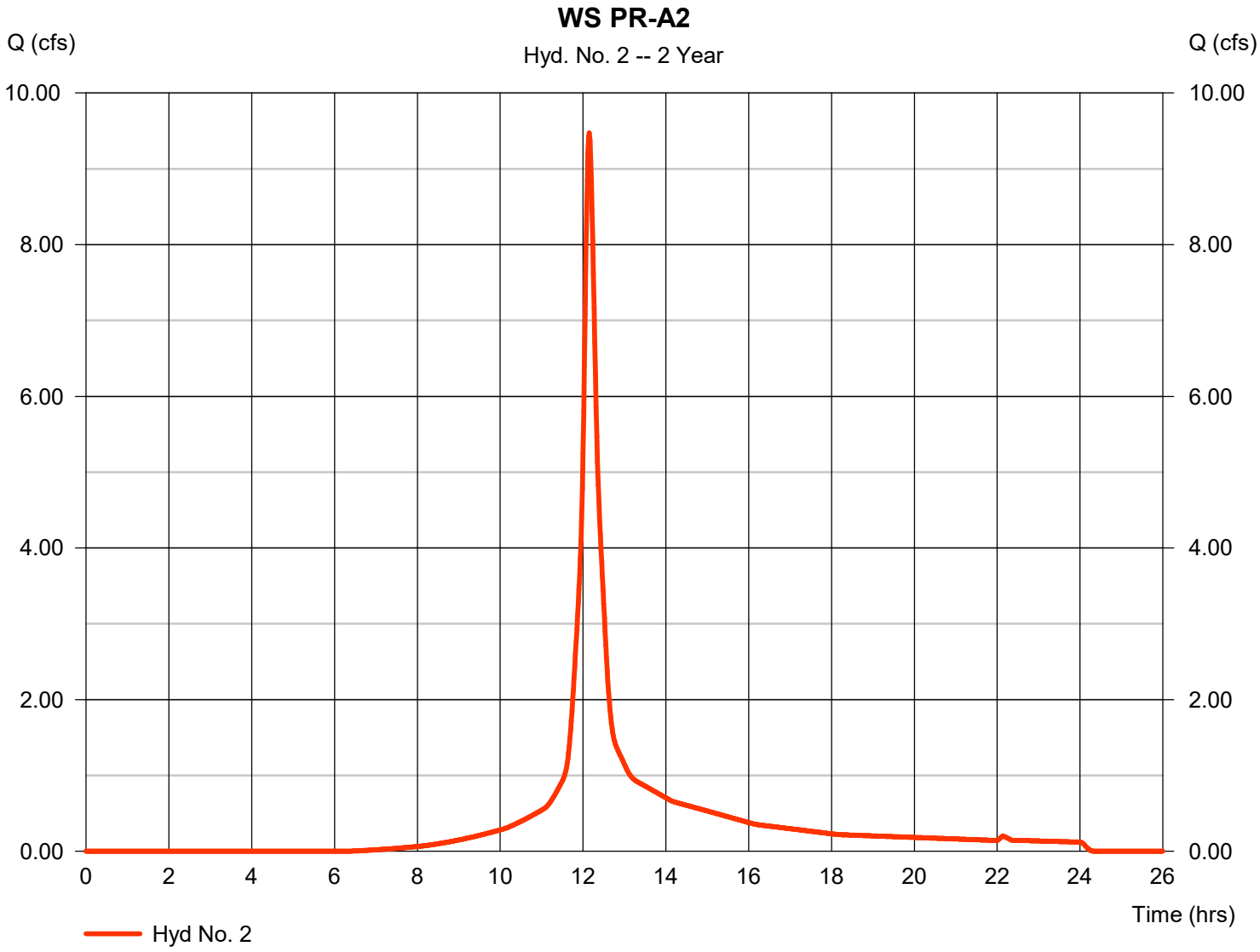


Hydrograph Report

Hyd. No. 2

WS PR-A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.473 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.15 hrs
Time interval	=	1 min	Hyd. volume	=	35,874 cuft
Drainage area	=	4.620 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	12.00 min
Total precip.	=	3.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

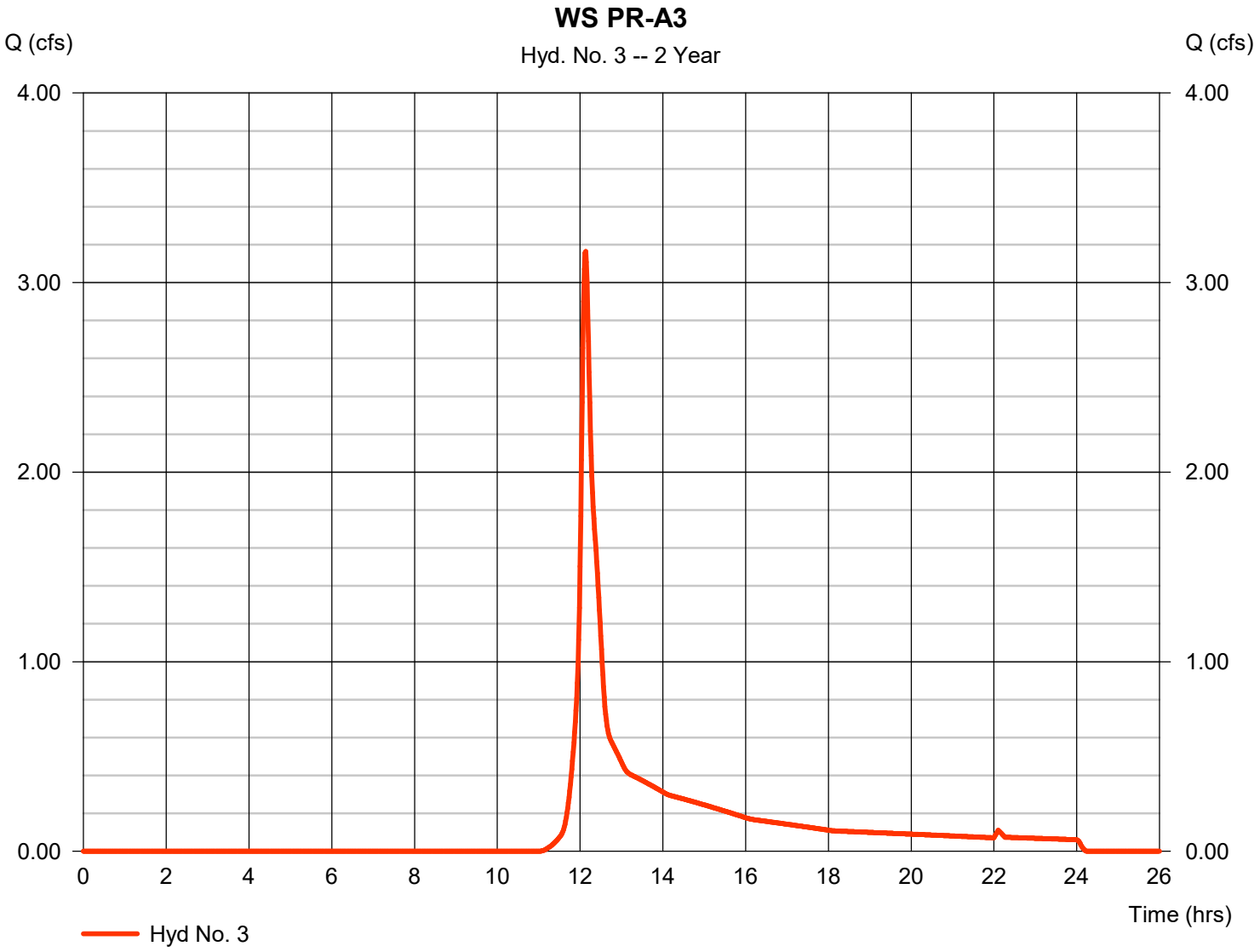


Hydrograph Report

Hyd. No. 3

WS PR-A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.164 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.13 hrs
Time interval	=	1 min	Hyd. volume	=	11,791 cuft
Drainage area	=	3.460 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

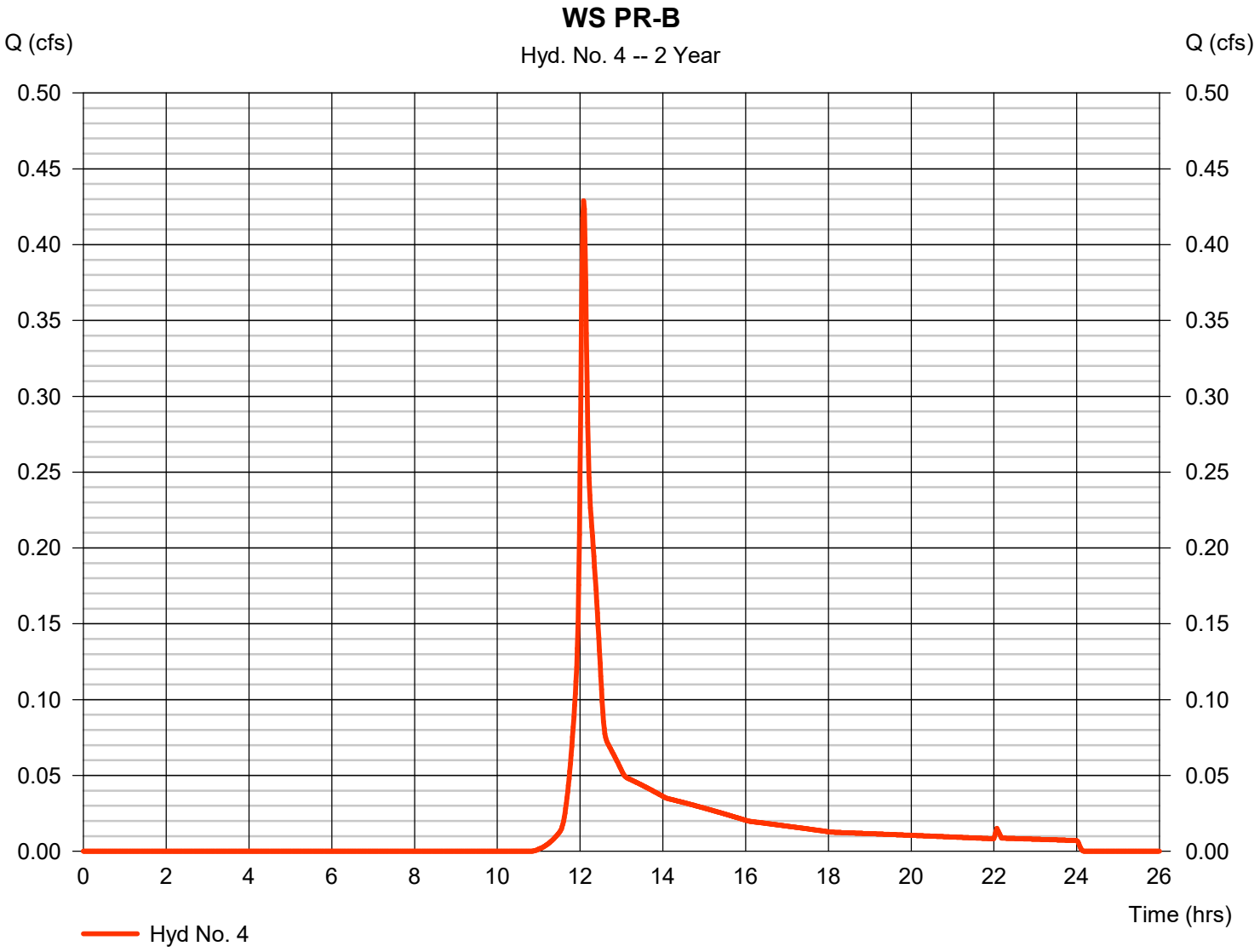


Hydrograph Report

Hyd. No. 4

WS PR-B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.429 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	1,412 cuft
Drainage area	=	0.380 ac	Curve number	=	72
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

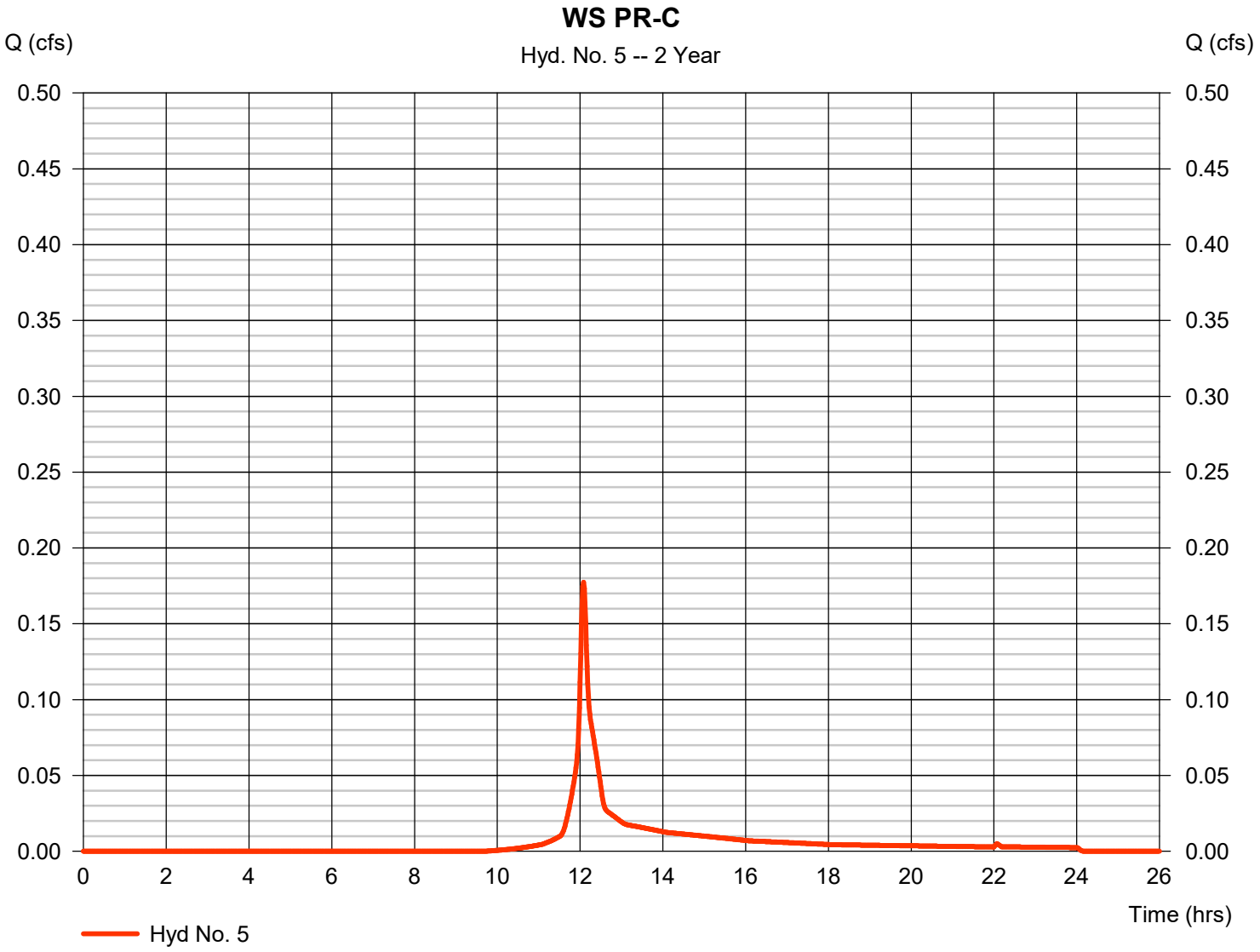


Hydrograph Report

Hyd. No. 5

WS PR-C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.177 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	555 cuft
Drainage area	=	0.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



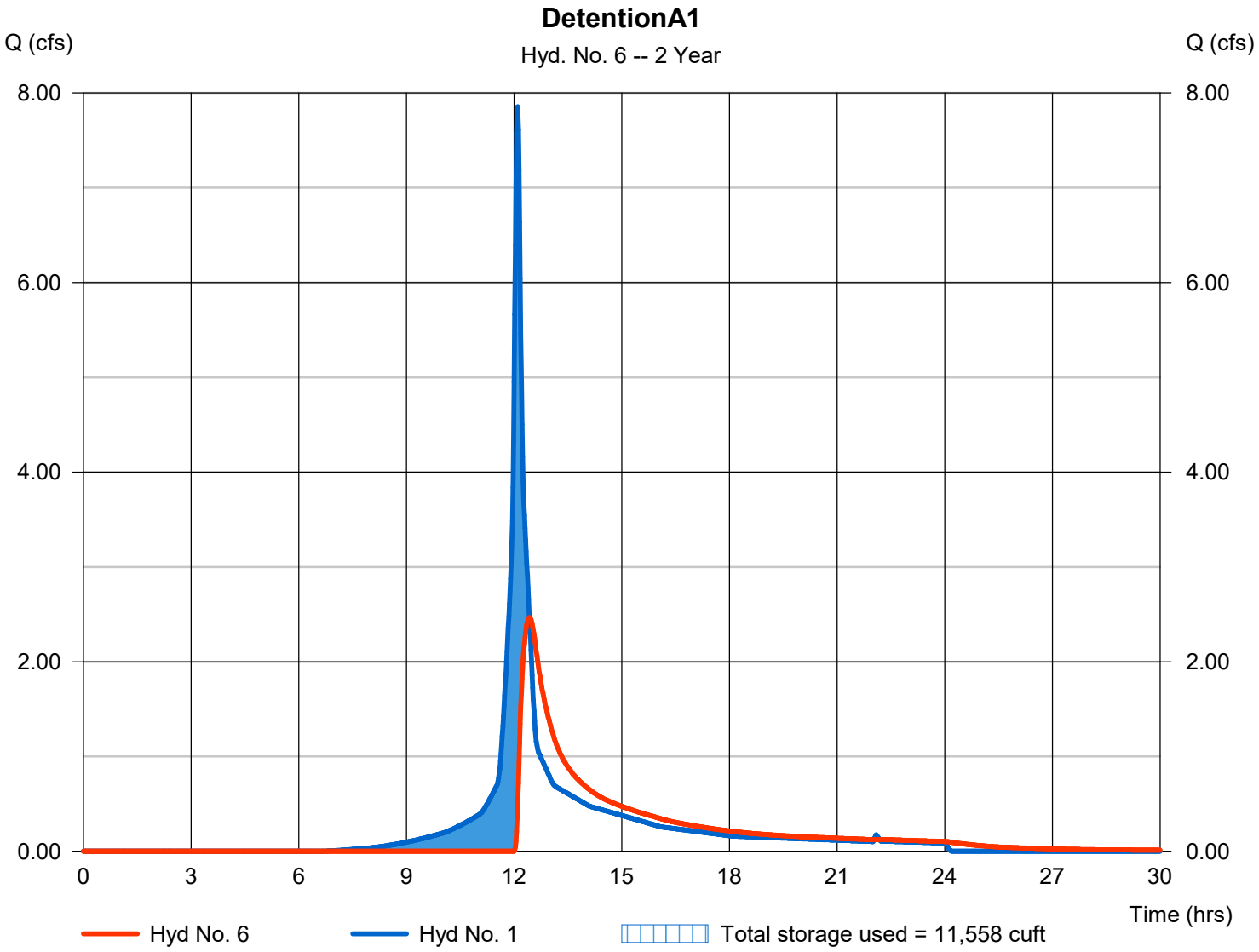
Hydrograph Report

Hyd. No. 6

DetentionA1

Hydrograph type	=	Reservoir	Peak discharge	=	2.464 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.42 hrs
Time interval	=	1 min	Hyd. volume	=	19,064 cuft
Inflow hyd. No.	=	1 - WS PR-A1	Max. Elevation	=	48.40 ft
Reservoir name	=	Underground Detention A1	Max. Storage	=	11,558 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Underground Detention A1

Pond Data

UG Chambers -Invert elev. = 47.25 ft, Rise x Span = 2.50 x 3.25 ft, Barrel Len = 155.50 ft, No. Barrels = 13, Slope = 0.00%, Headers = Yes
Encasement -Invert elev. = 46.75 ft, Width = 4.86 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	46.75	n/a	0	0
0.35	47.10	n/a	1,462	1,462
0.70	47.45	n/a	2,299	3,760
1.05	47.80	n/a	2,910	6,670
1.40	48.15	n/a	2,864	9,534
1.75	48.50	n/a	2,784	12,318
2.10	48.85	n/a	2,664	14,982
2.45	49.20	n/a	2,491	17,473
2.80	49.55	n/a	2,226	19,698
3.15	49.90	n/a	1,682	21,380
3.50	50.25	n/a	1,462	22,842

Culvert / Orifice Structures

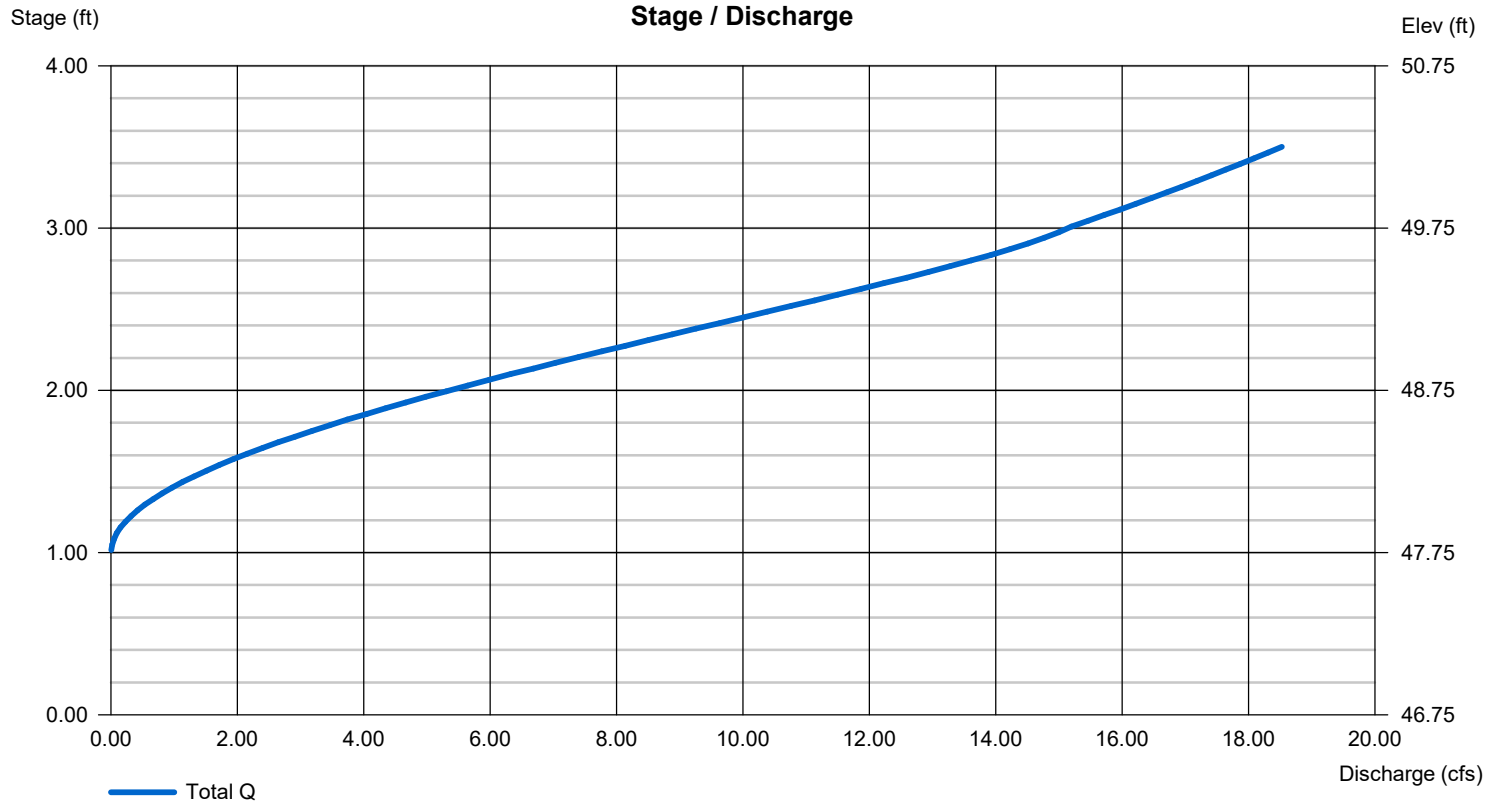
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	Inactive	Inactive	0.00
Span (in)	= 24.00	24.00	6.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 47.75	47.75	48.25	0.00
Length (ft)	= 48.00	0.00	0.00	0.00
Slope (%)	= 3.12	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	0.00	0.00	0.00
Crest El. (ft)	= 50.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



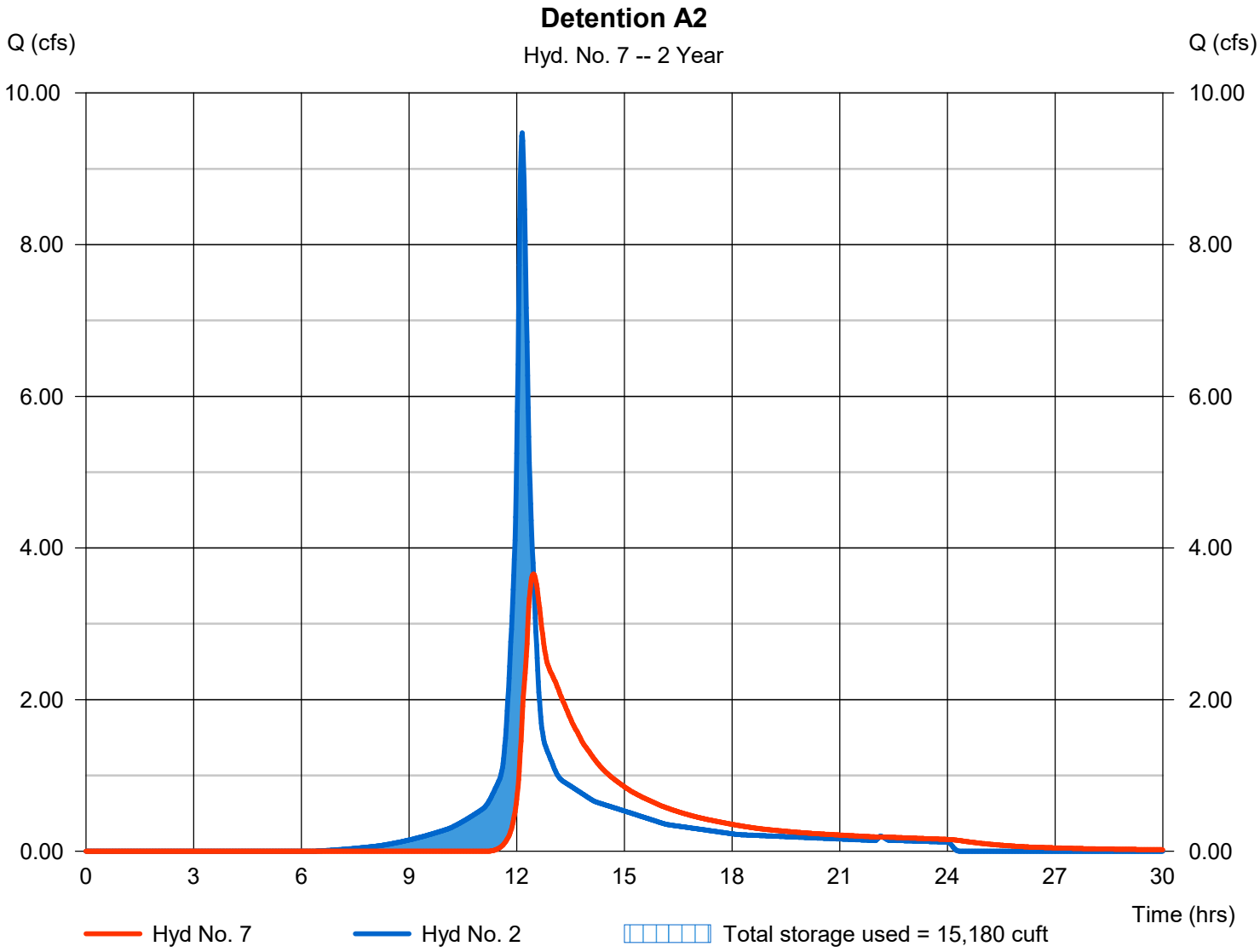
Hydrograph Report

Hyd. No. 7

Detention A2

Hydrograph type	= Reservoir	Peak discharge	= 3.655 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.47 hrs
Time interval	= 1 min	Hyd. volume	= 32,607 cuft
Inflow hyd. No.	= 2 - WS PR-A2	Max. Elevation	= 44.96 ft
Reservoir name	= Underground Detention A2	Max. Storage	= 15,180 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Underground Detention A2

Pond Data

UG Chambers -Invert elev. = 43.75 ft, Rise x Span = 2.50 x 3.35 ft, Barrel Len = 213.75 ft, No. Barrels = 12, Slope = 0.00%, Headers = Yes
Encasement -Invert elev. = 43.25 ft, Width = 4.88 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	43.25	n/a	0	0
0.35	43.60	n/a	1,833	1,833
0.70	43.95	n/a	2,910	4,743
1.05	44.30	n/a	3,697	8,440
1.40	44.65	n/a	3,637	12,077
1.75	45.00	n/a	3,535	15,612
2.10	45.35	n/a	3,381	18,992
2.45	45.70	n/a	3,157	22,149
2.80	46.05	n/a	2,816	24,965
3.15	46.40	n/a	2,117	27,082
3.50	46.75	n/a	1,833	28,915

Culvert / Orifice Structures

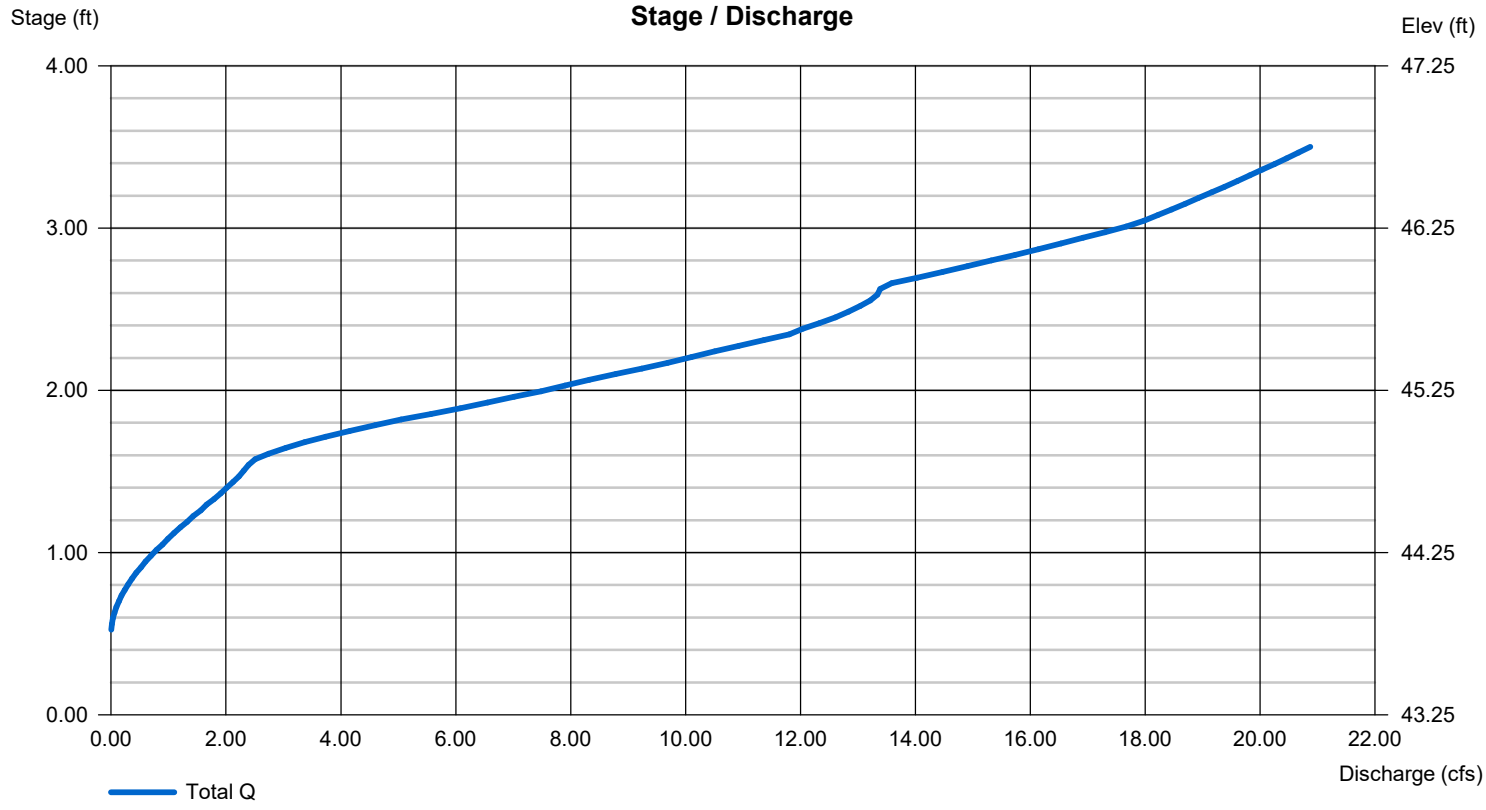
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	12.00	Inactive	0.00
Span (in)	= 24.00	12.00	8.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 43.75	43.75	44.25	0.00
Length (ft)	= 22.00	0.00	0.00	0.00
Slope (%)	= 2.25	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 44.80	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

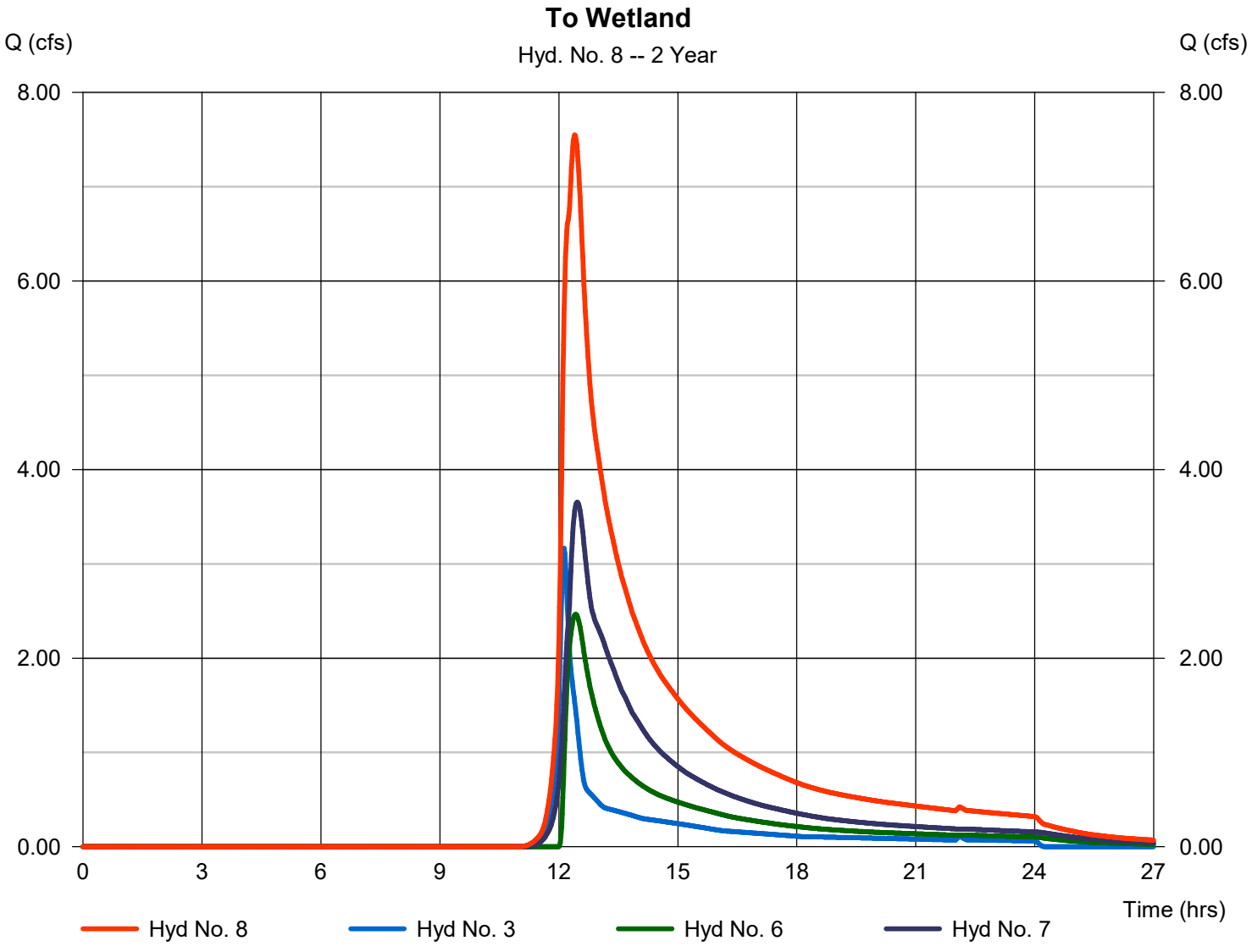


Hydrograph Report

Hyd. No. 8

To Wetland

Hydrograph type	= Combine	Peak discharge	= 7.551 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.40 hrs
Time interval	= 1 min	Hyd. volume	= 63,462 cuft
Inflow hyds.	= 3, 6, 7	Contrib. drain. area	= 3.460 ac

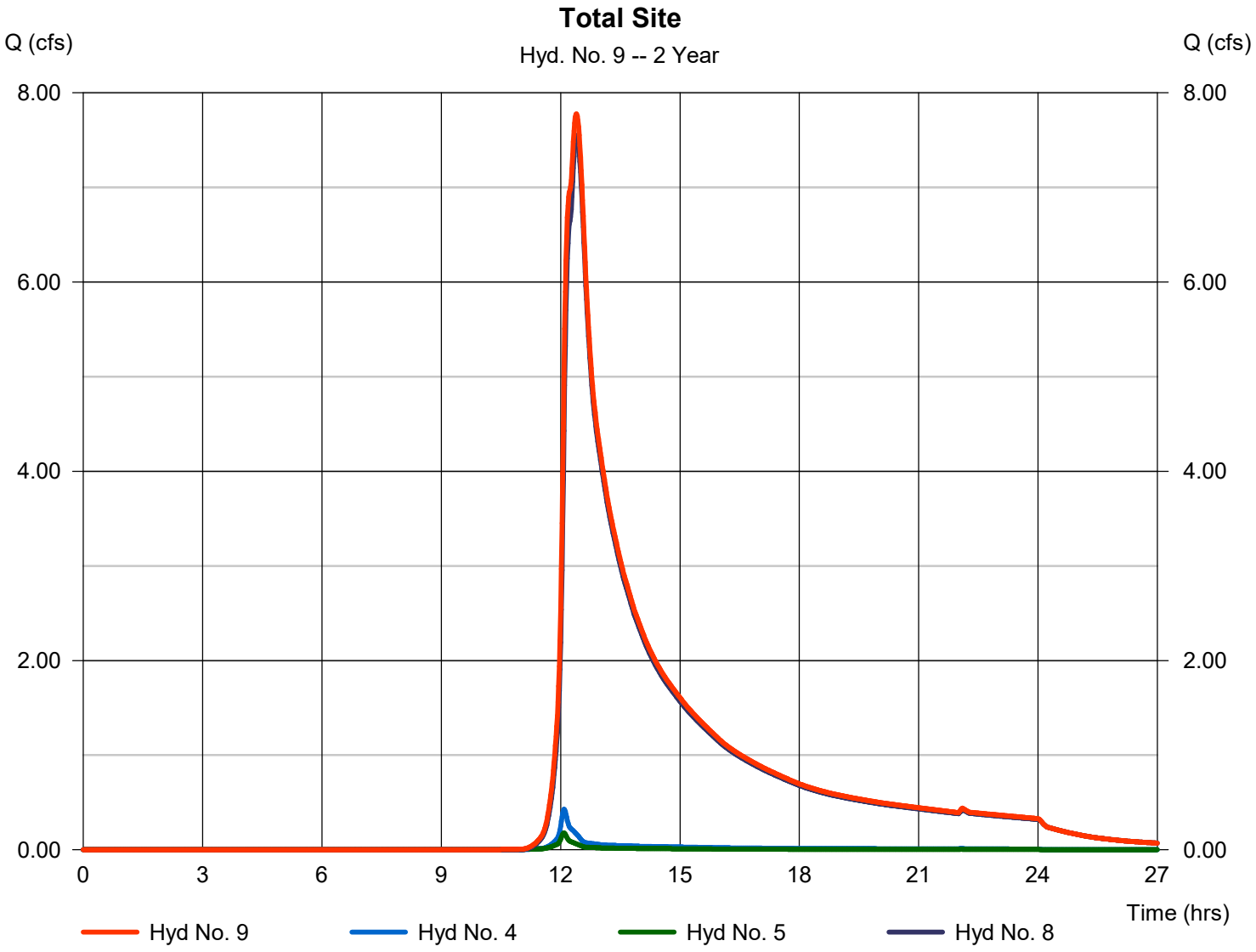


Hydrograph Report

Hyd. No. 9

Total Site

Hydrograph type	= Combine	Peak discharge	= 7.777 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.40 hrs
Time interval	= 1 min	Hyd. volume	= 65,428 cuft
Inflow hyds.	= 4, 5, 8	Contrib. drain. area	= 0.490 ac

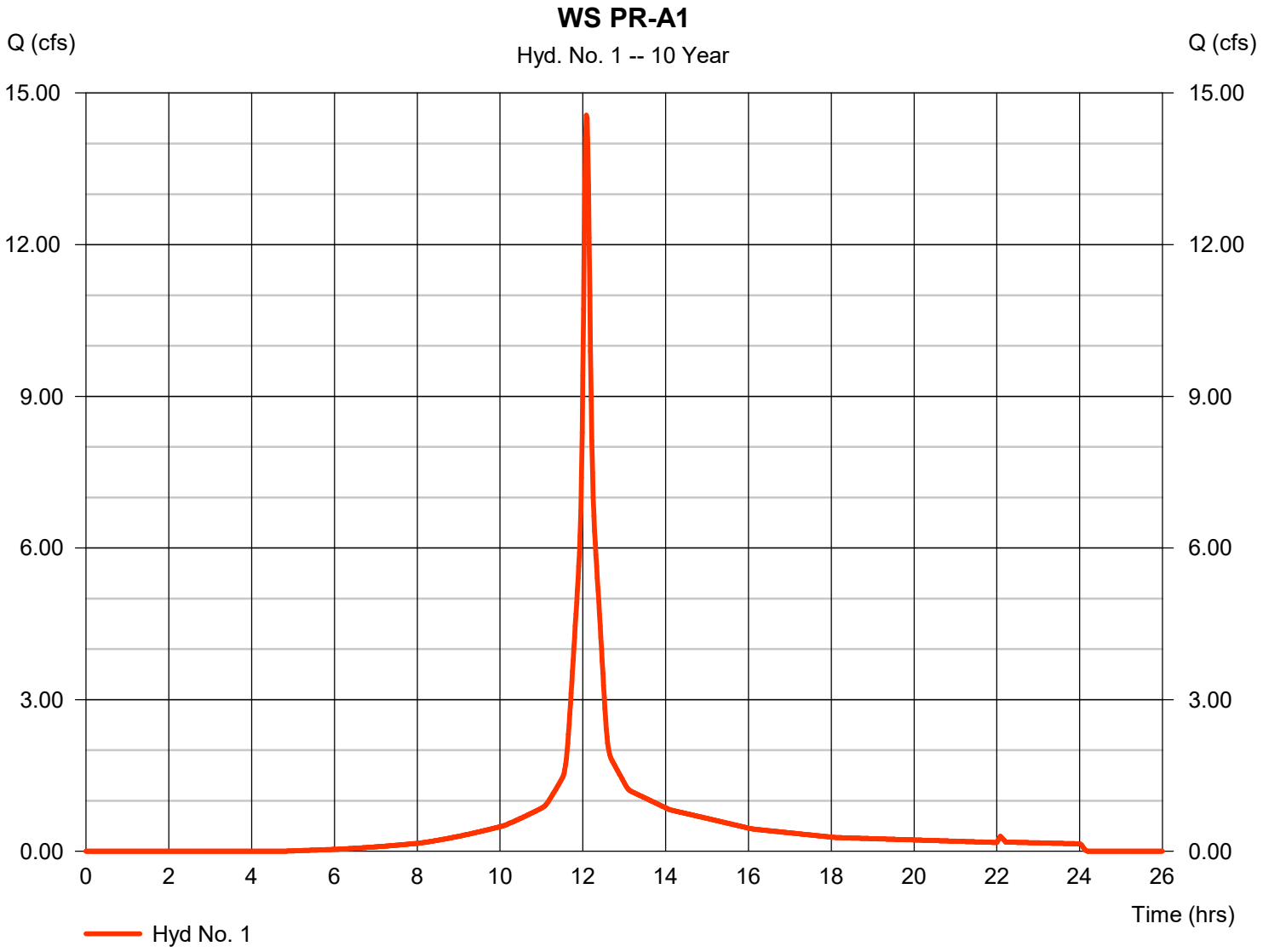


Hydrograph Report

Hyd. No. 1

WS PR-A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.56 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	48,147 cuft
Drainage area	=	3.440 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	8.00 min
Total precip.	=	5.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

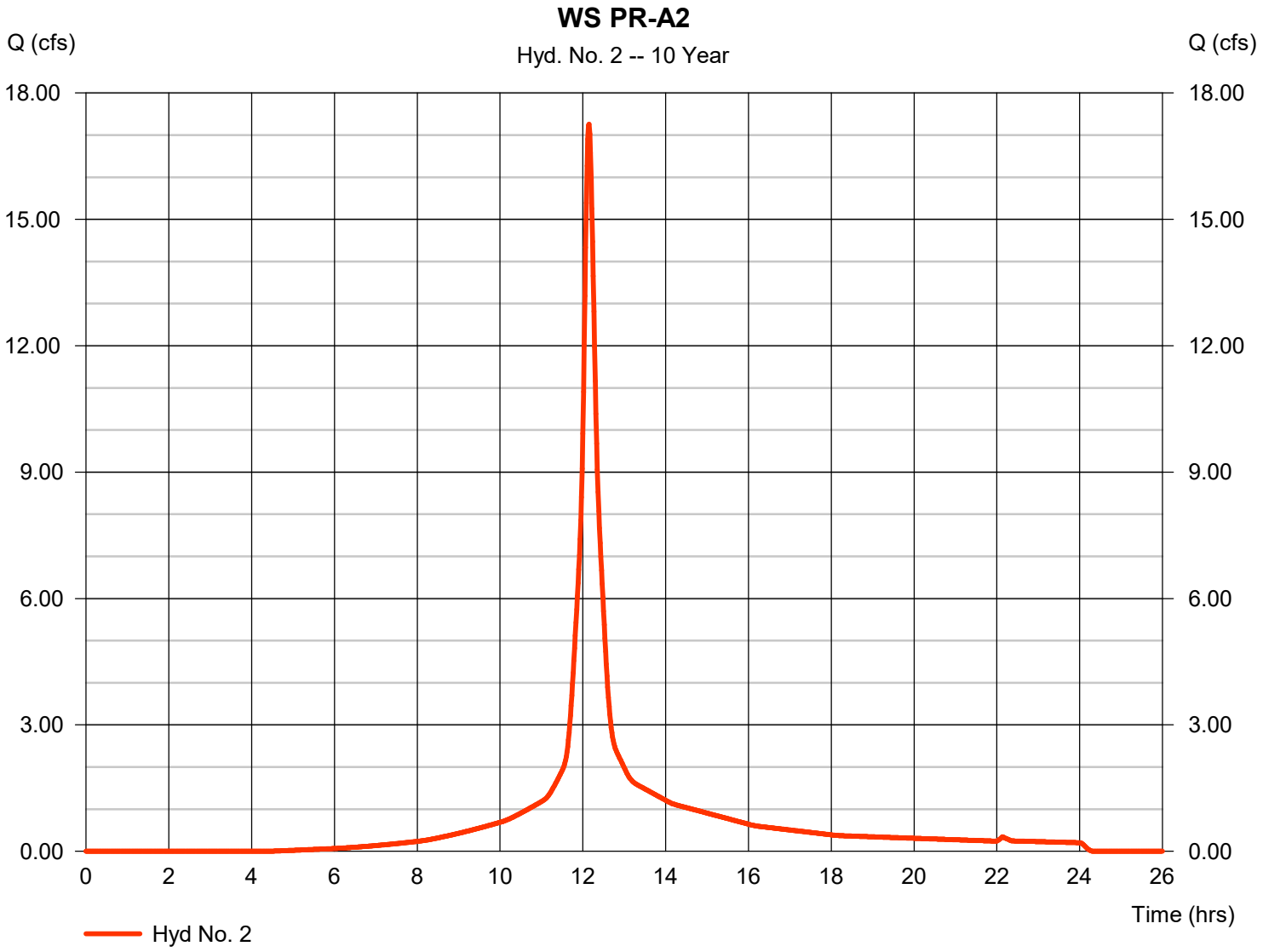


Hydrograph Report

Hyd. No. 2

WS PR-A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.26 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.15 hrs
Time interval	=	1 min	Hyd. volume	=	67,021 cuft
Drainage area	=	4.620 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	12.00 min
Total precip.	=	5.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

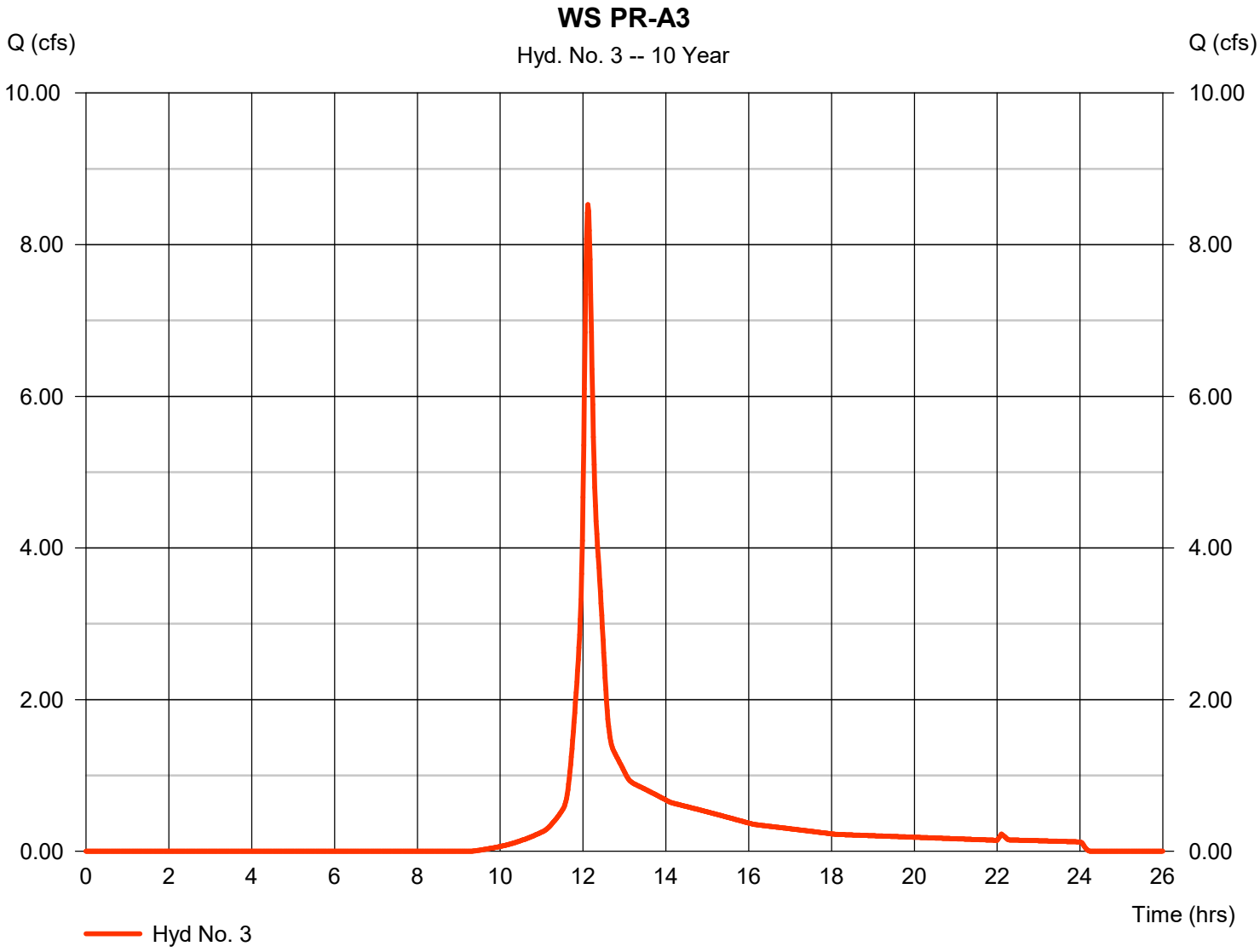


Hydrograph Report

Hyd. No. 3

WS PR-A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.527 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	29,463 cuft
Drainage area	=	3.460 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

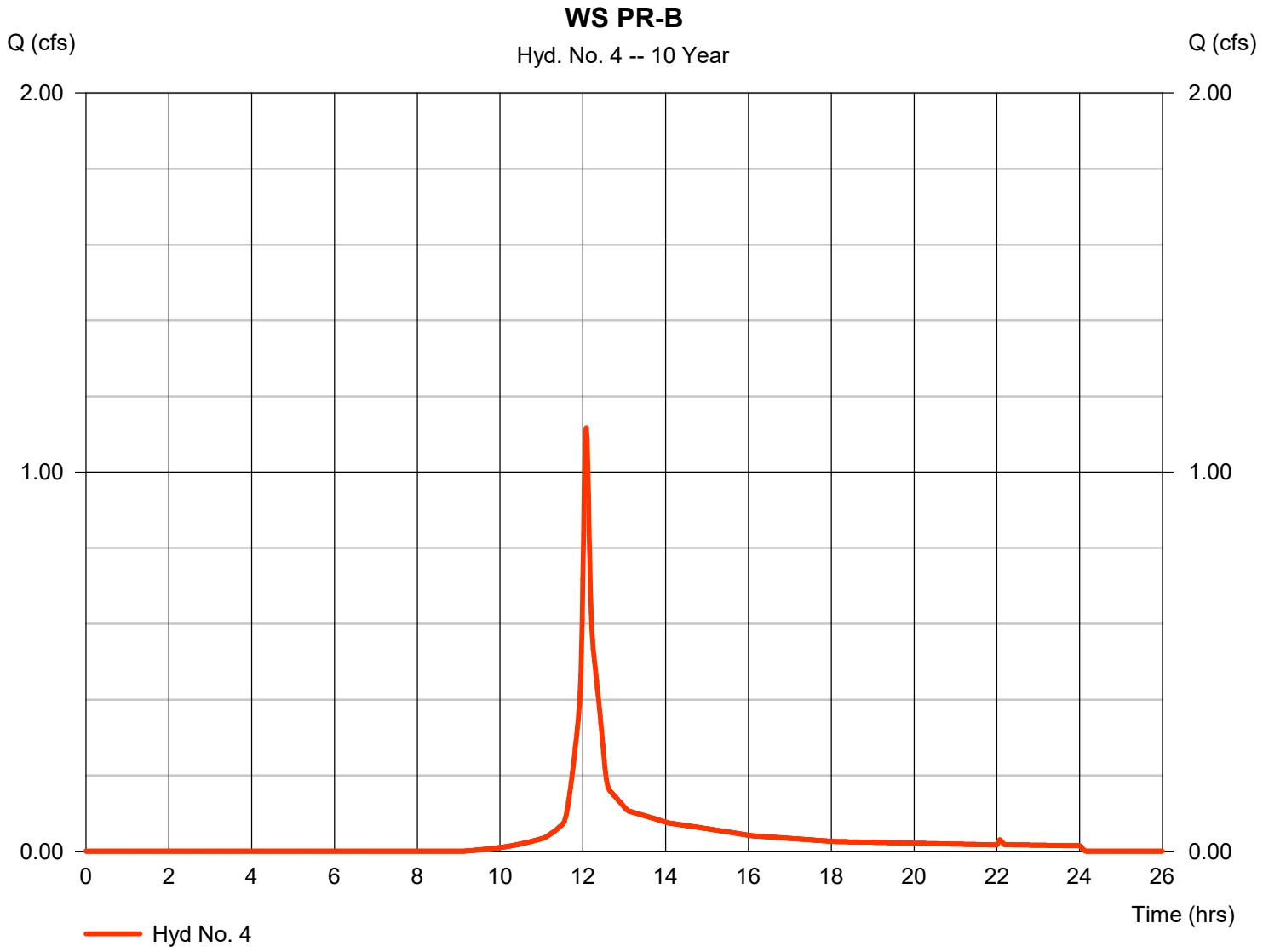


Hydrograph Report

Hyd. No. 4

WS PR-B

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.117 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	3,459 cuft
Drainage area	=	0.380 ac	Curve number	=	72
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

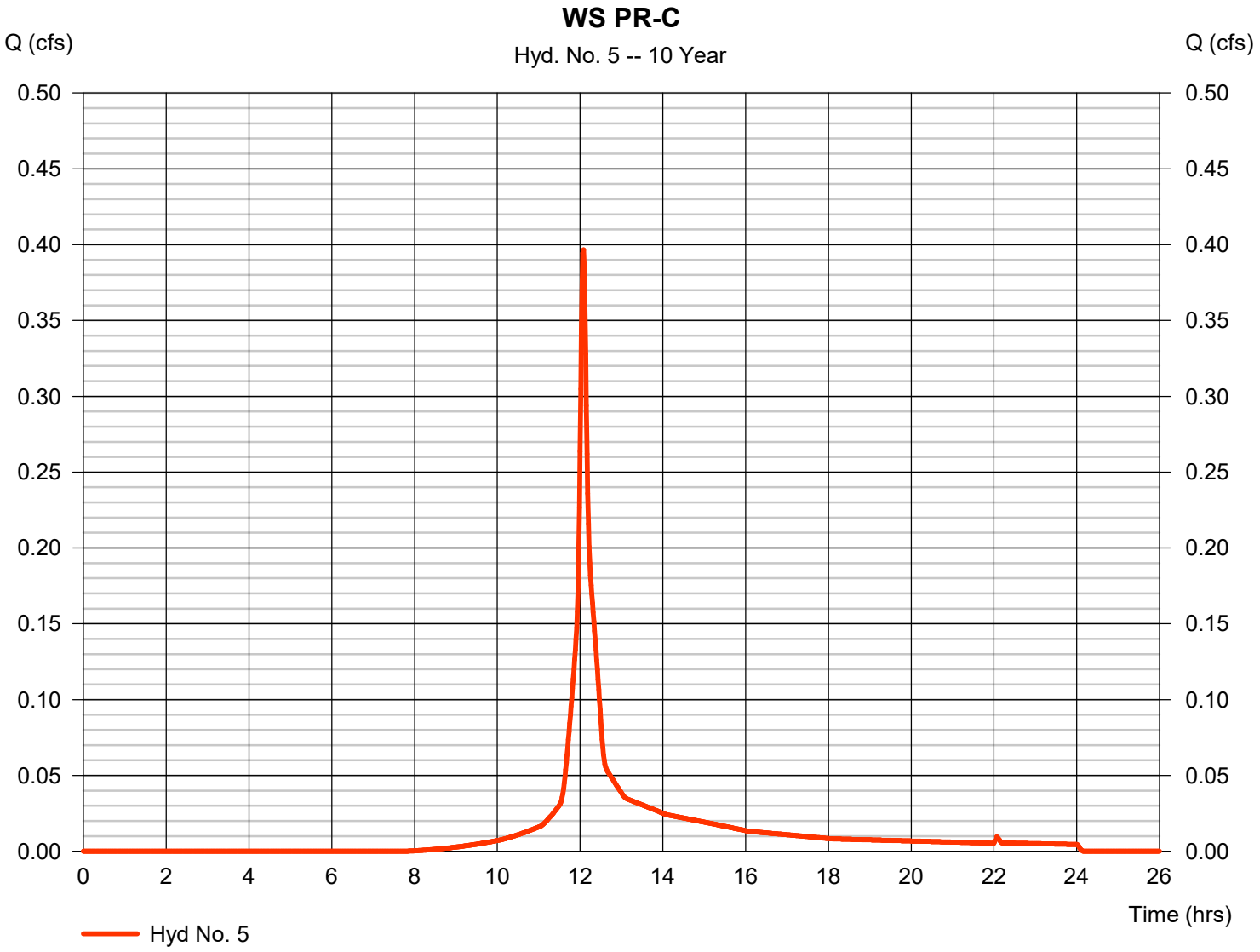


Hydrograph Report

Hyd. No. 5

WS PR-C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.397 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	1,222 cuft
Drainage area	=	0.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	5.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



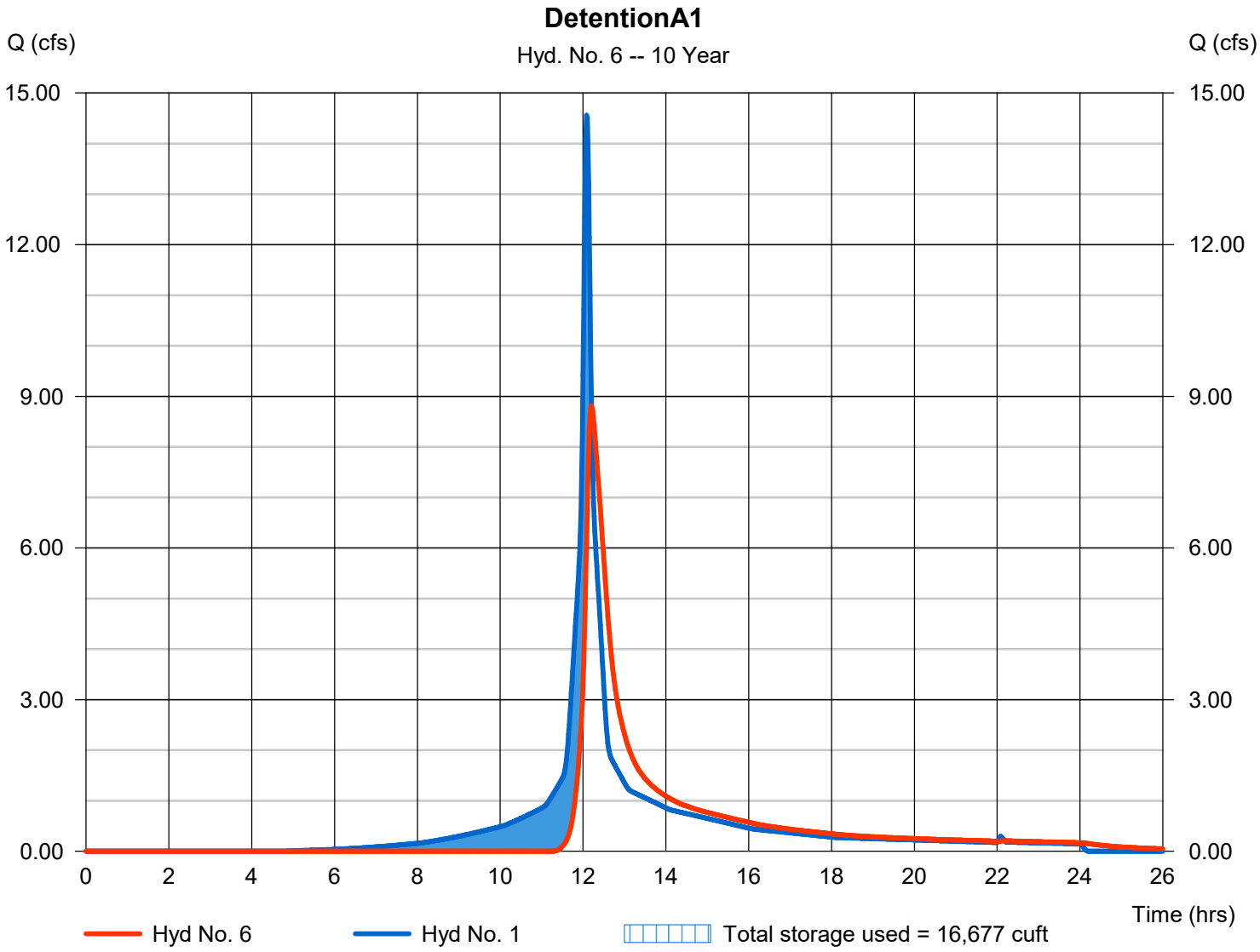
Hydrograph Report

Hyd. No. 6

DetentionA1

Hydrograph type	=	Reservoir	Peak discharge	=	8.807 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.20 hrs
Time interval	=	1 min	Hyd. volume	=	41,798 cuft
Inflow hyd. No.	=	1 - WS PR-A1	Max. Elevation	=	49.09 ft
Reservoir name	=	Underground Detention A1	Max. Storage	=	16,677 cuft

Storage Indication method used.



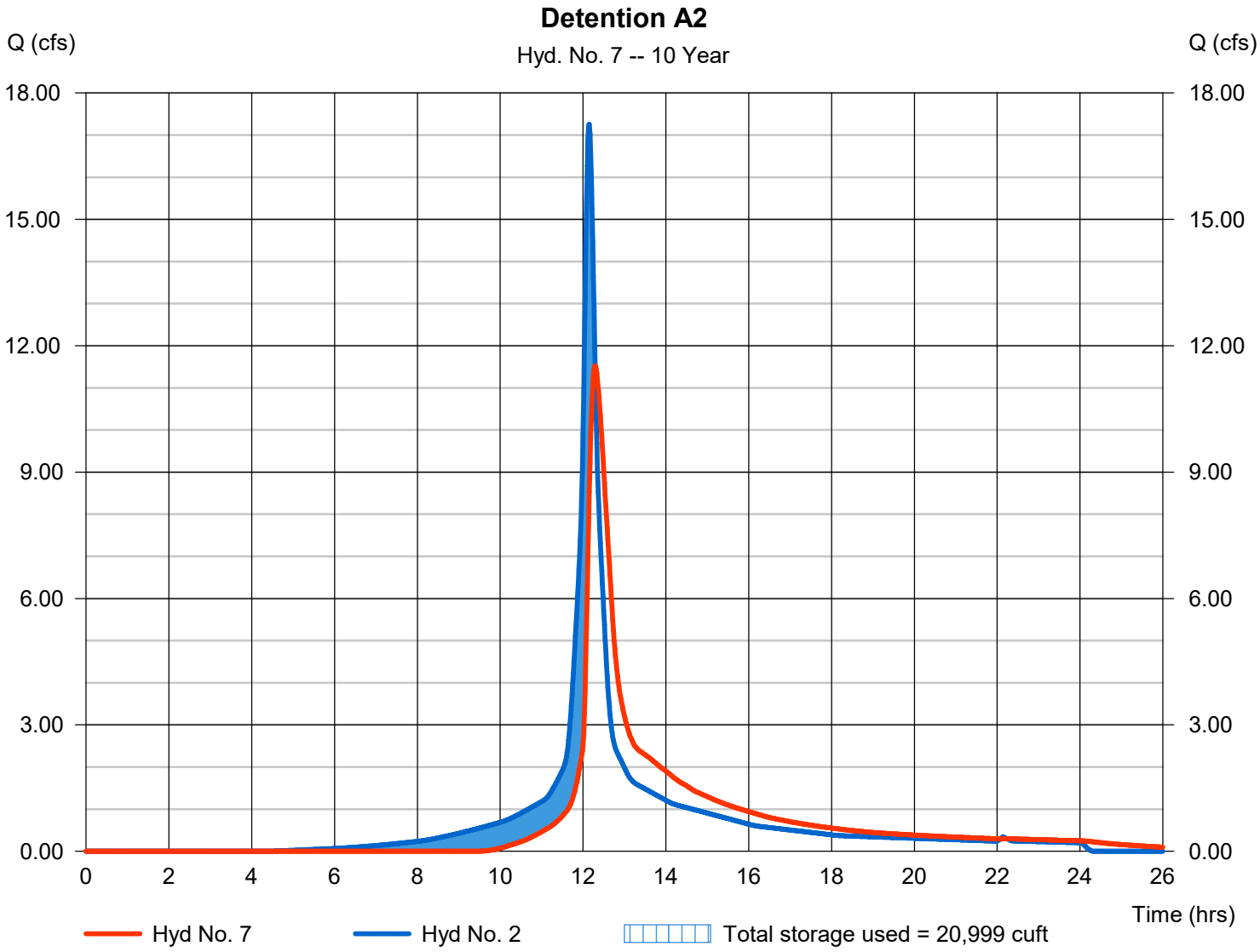
Hydrograph Report

Hyd. No. 7

Detention A2

Hydrograph type	=	Reservoir	Peak discharge	=	11.52 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.30 hrs
Time interval	=	1 min	Hyd. volume	=	63,746 cuft
Inflow hyd. No.	=	2 - WS PR-A2	Max. Elevation	=	45.57 ft
Reservoir name	=	Underground Detention A2	Max. Storage	=	20,999 cuft

Storage Indication method used.

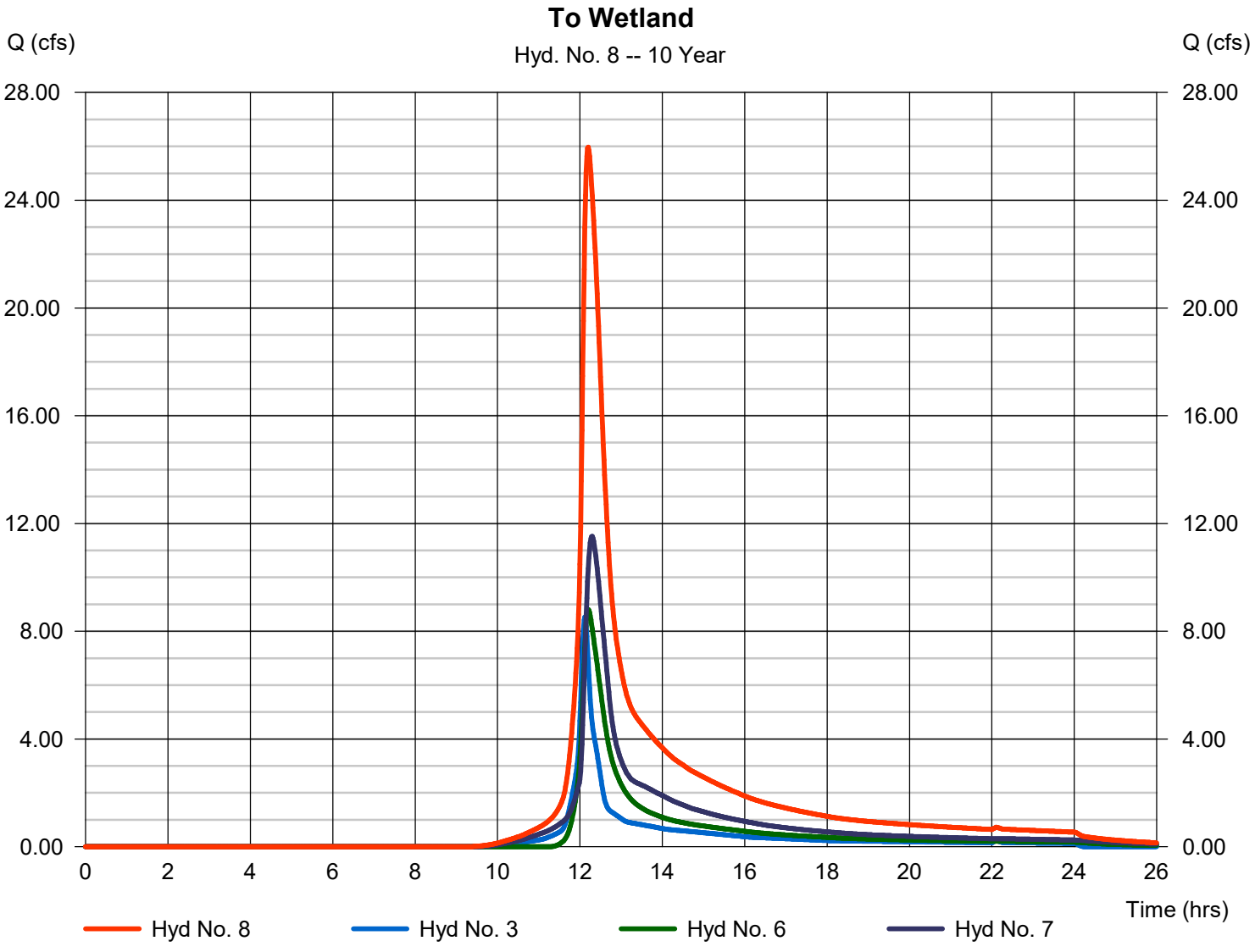


Hydrograph Report

Hyd. No. 8

To Wetland

Hydrograph type	= Combine	Peak discharge	= 25.98 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 1 min	Hyd. volume	= 135,007 cuft
Inflow hyds.	= 3, 6, 7	Contrib. drain. area	= 3.460 ac

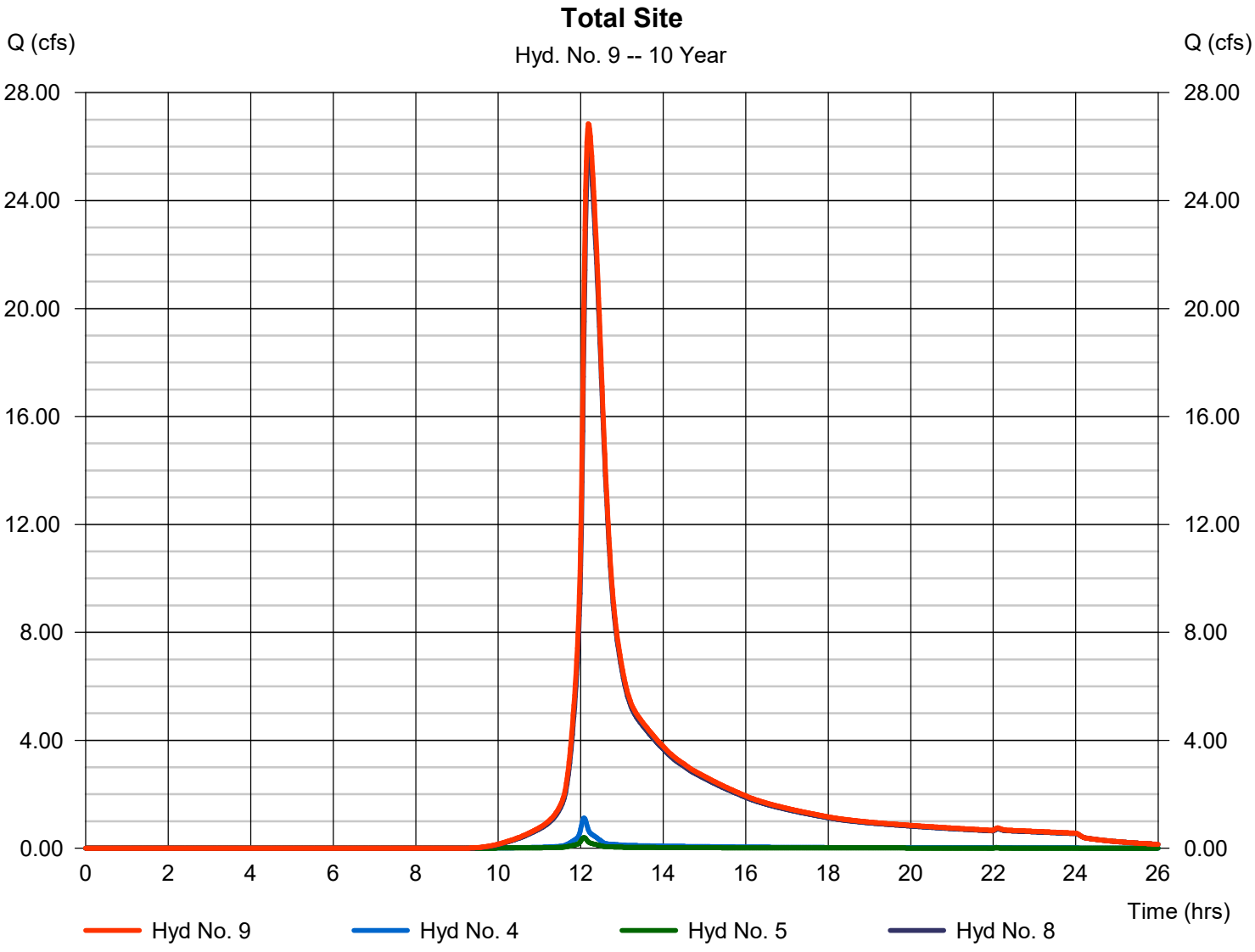


Hydrograph Report

Hyd. No. 9

Total Site

Hydrograph type	= Combine	Peak discharge	= 26.85 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.18 hrs
Time interval	= 1 min	Hyd. volume	= 139,688 cuft
Inflow hyds.	= 4, 5, 8	Contrib. drain. area	= 0.490 ac

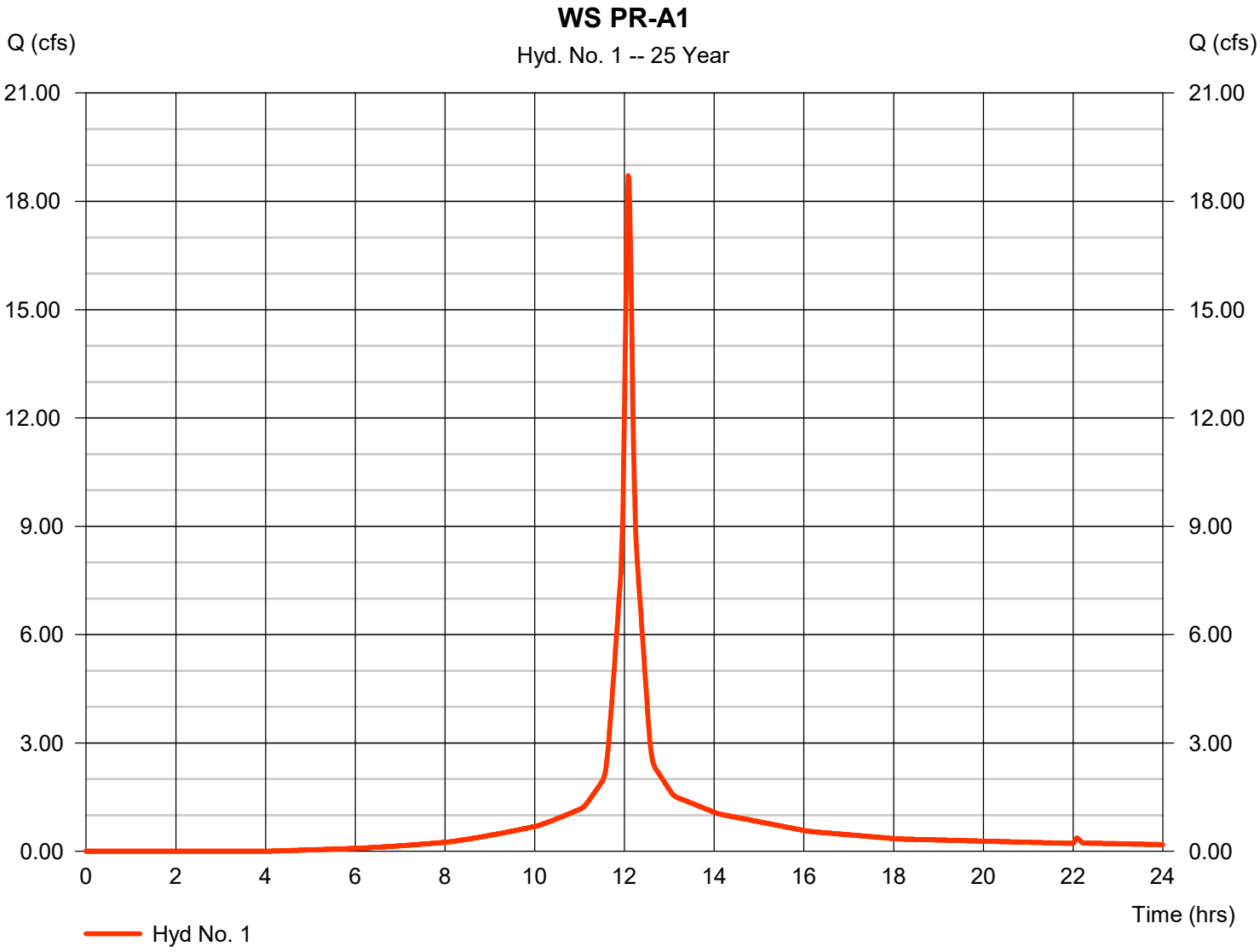


Hydrograph Report

Hyd. No. 1

WS PR-A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.71 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	62,669 cuft
Drainage area	=	3.440 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	8.00 min
Total precip.	=	6.54 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

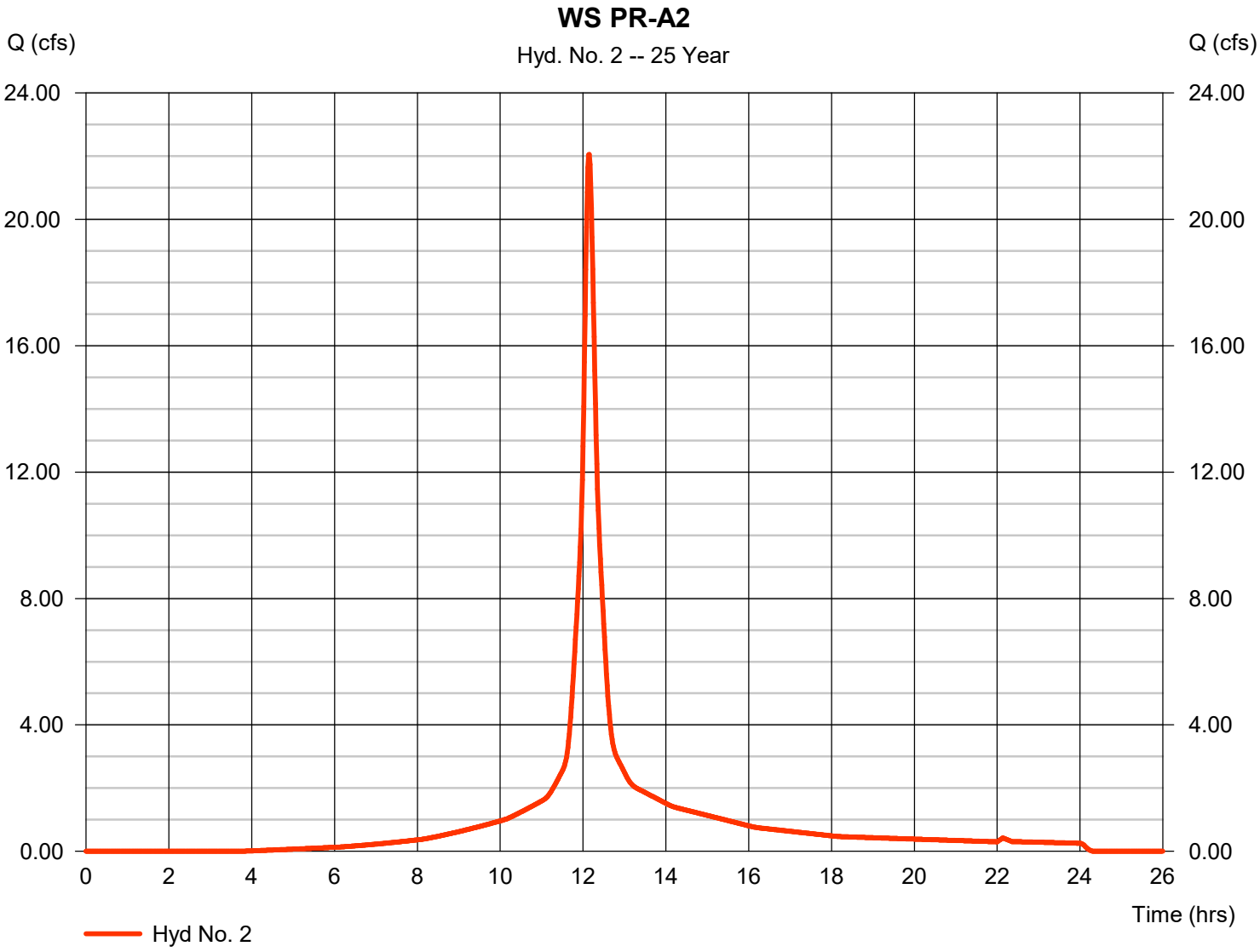


Hydrograph Report

Hyd. No. 2

WS PR-A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.06 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.15 hrs
Time interval	=	1 min	Hyd. volume	=	86,831 cuft
Drainage area	=	4.620 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	12.00 min
Total precip.	=	6.54 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

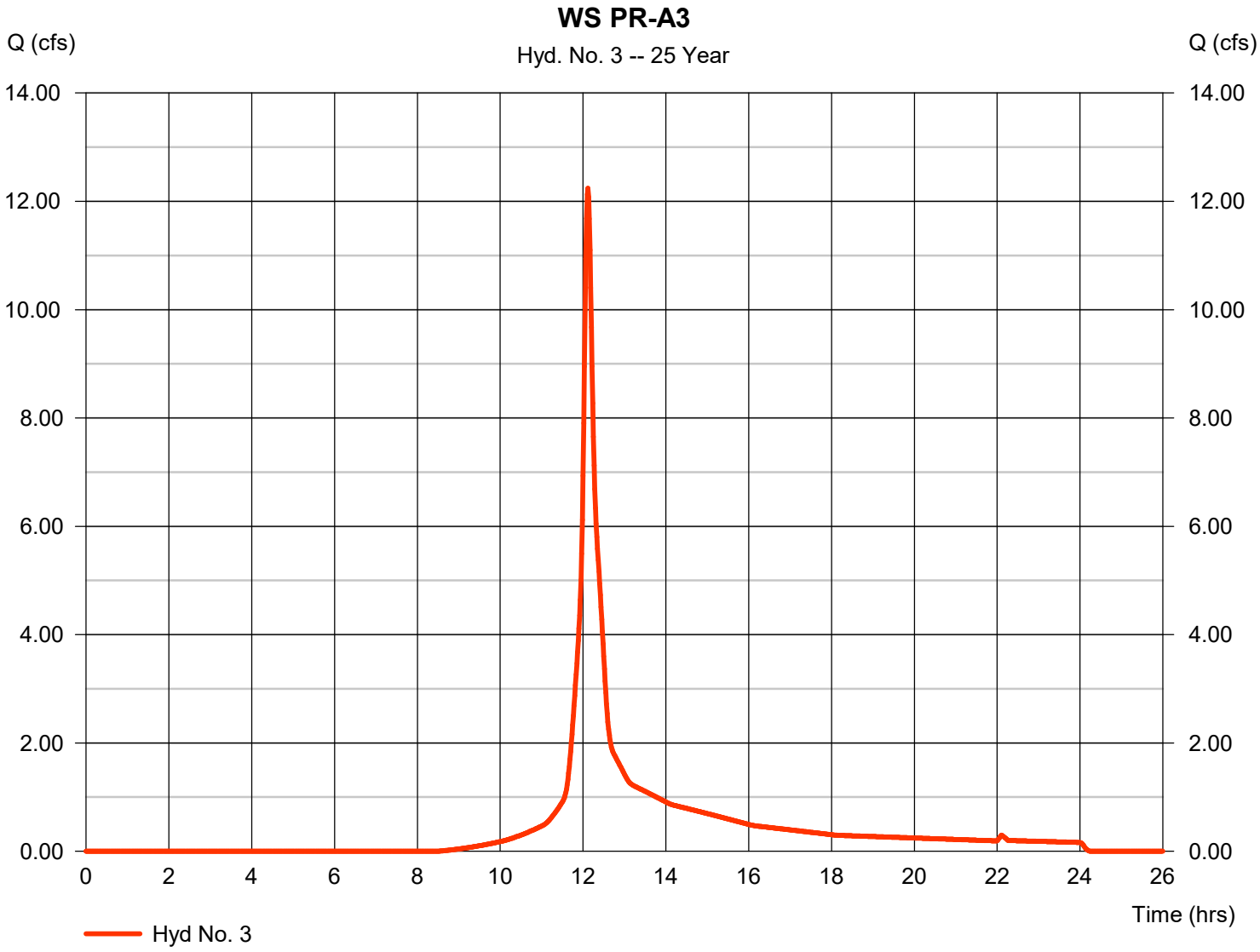


Hydrograph Report

Hyd. No. 3

WS PR-A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.24 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	41,945 cuft
Drainage area	=	3.460 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.54 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

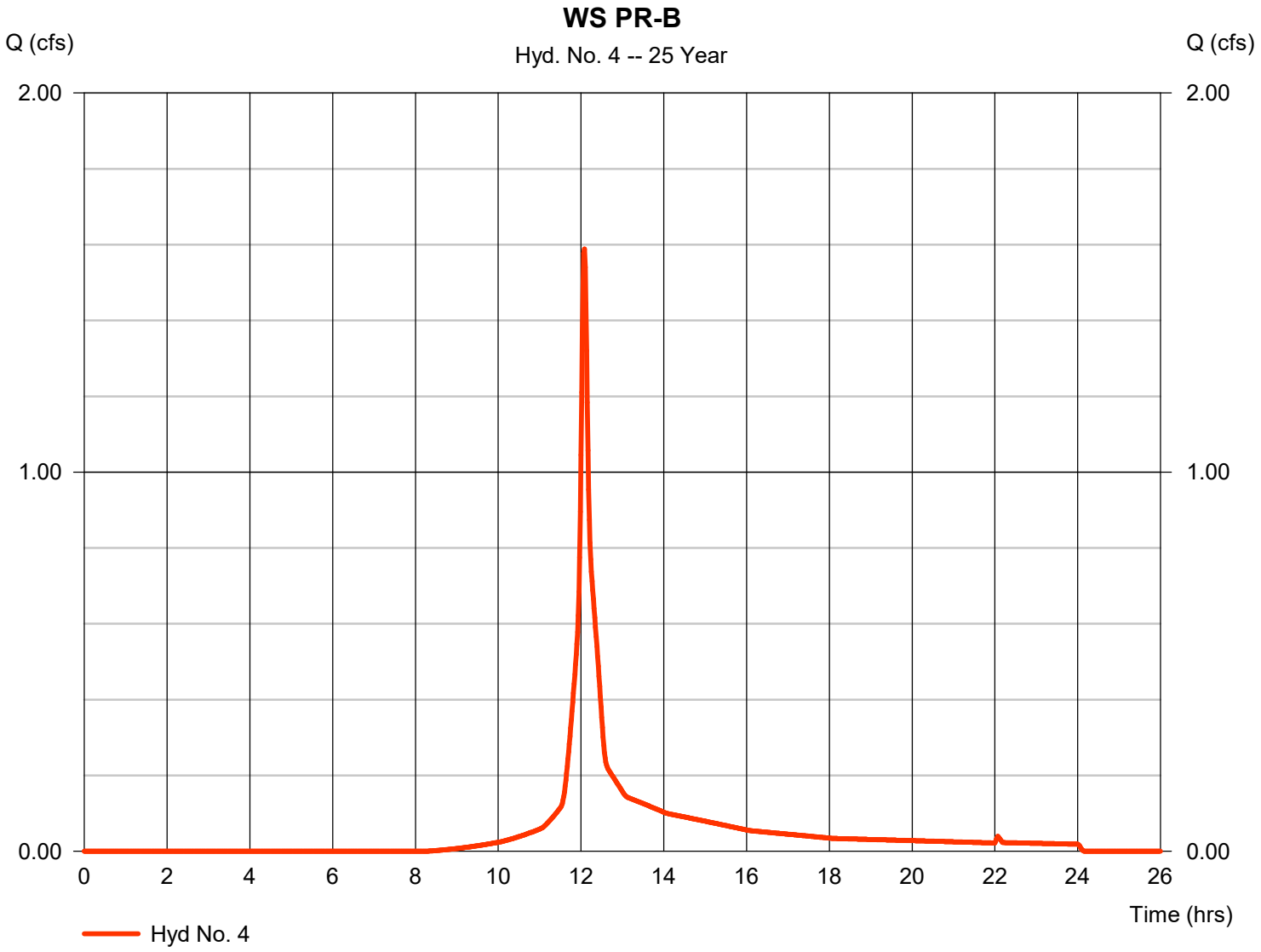


Hydrograph Report

Hyd. No. 4

WS PR-B

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.589 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	4,894 cuft
Drainage area	=	0.380 ac	Curve number	=	72
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.54 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

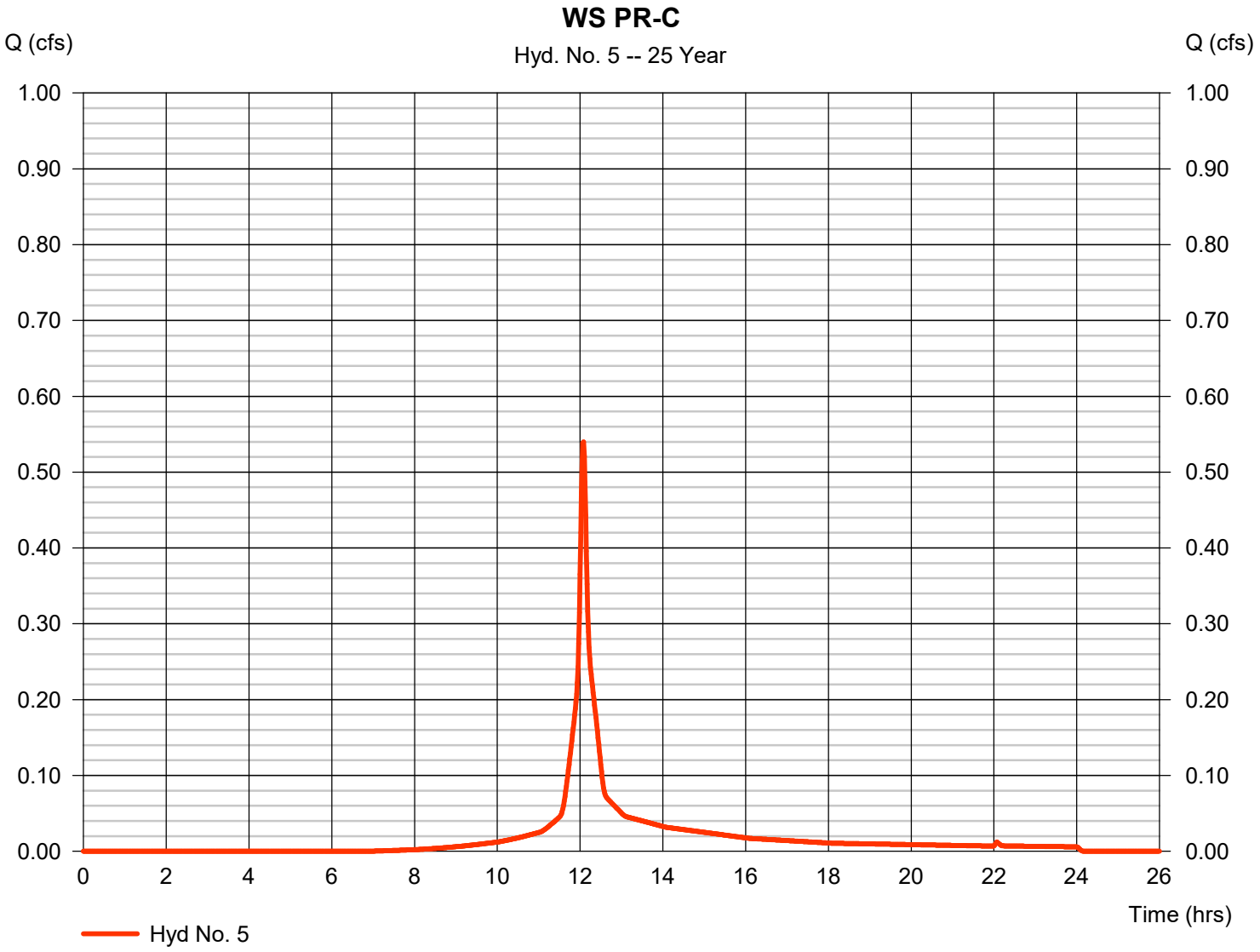


Hydrograph Report

Hyd. No. 5

WS PR-C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.540 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	1,672 cuft
Drainage area	=	0.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.54 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



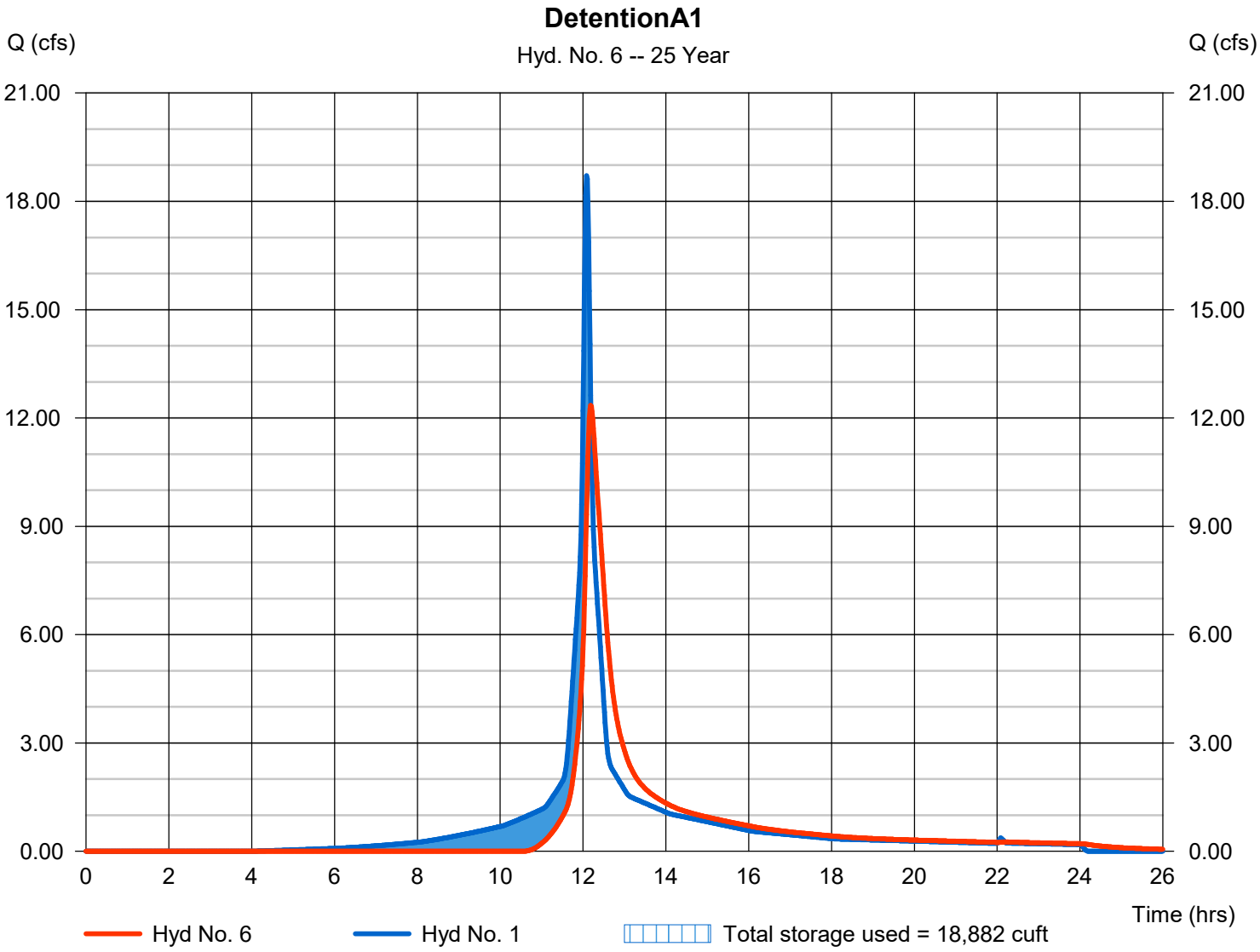
Hydrograph Report

Hyd. No. 6

DetentionA1

Hydrograph type	=	Reservoir	Peak discharge	=	12.35 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.18 hrs
Time interval	=	1 min	Hyd. volume	=	56,318 cuft
Inflow hyd. No.	=	1 - WS PR-A1	Max. Elevation	=	49.42 ft
Reservoir name	=	Underground Detention A1	Max. Storage	=	18,882 cuft

Storage Indication method used.



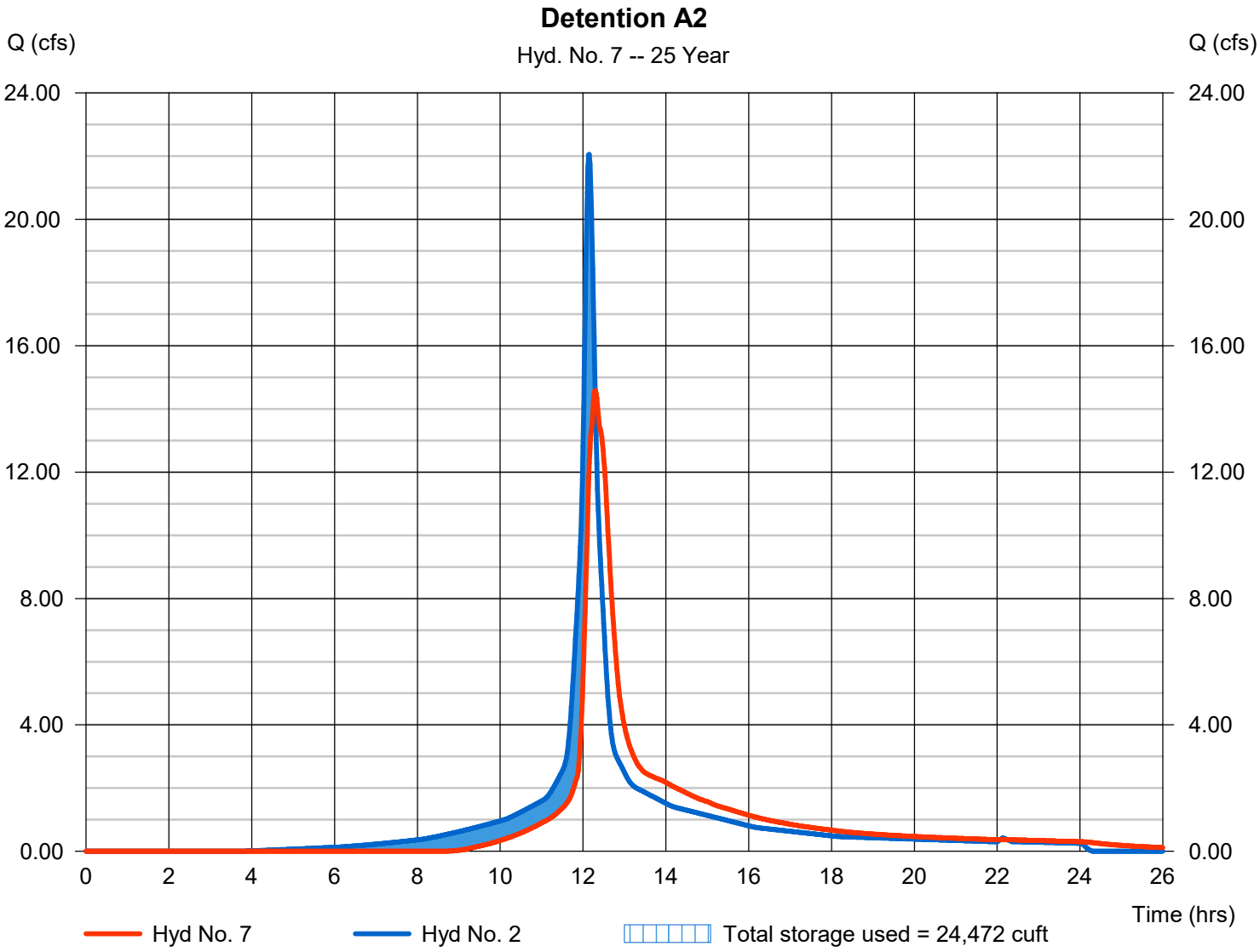
Hydrograph Report

Hyd. No. 7

Detention A2

Hydrograph type	=	Reservoir	Peak discharge	=	14.58 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.30 hrs
Time interval	=	1 min	Hyd. volume	=	83,554 cuft
Inflow hyd. No.	=	2 - WS PR-A2	Max. Elevation	=	45.99 ft
Reservoir name	=	Underground Detention A2	Max. Storage	=	24,472 cuft

Storage Indication method used.

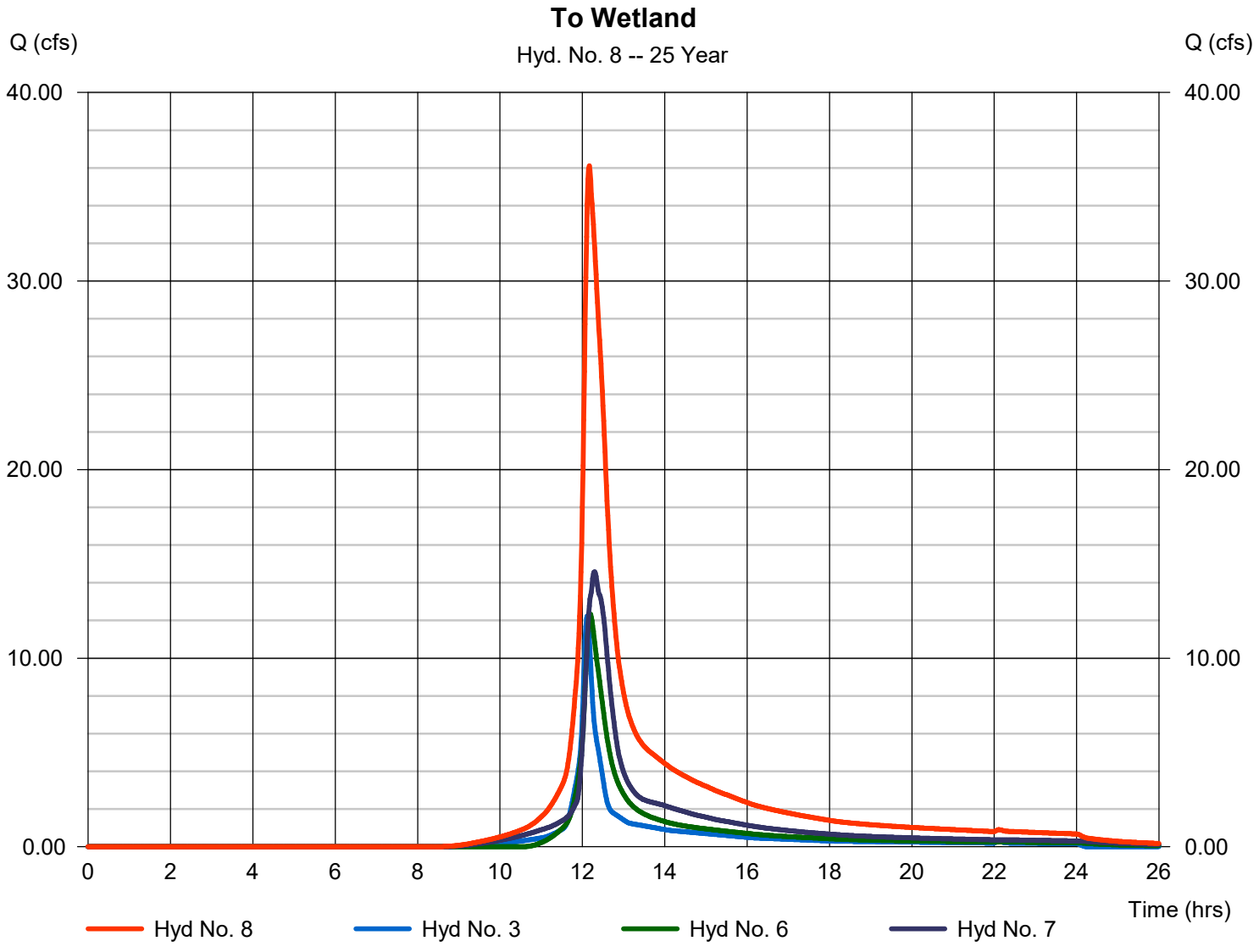


Hydrograph Report

Hyd. No. 8

To Wetland

Hydrograph type	=	Combine	Peak discharge	=	36.12 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.17 hrs
Time interval	=	1 min	Hyd. volume	=	181,817 cuft
Inflow hyds.	=	3, 6, 7	Contrib. drain. area	=	3.460 ac

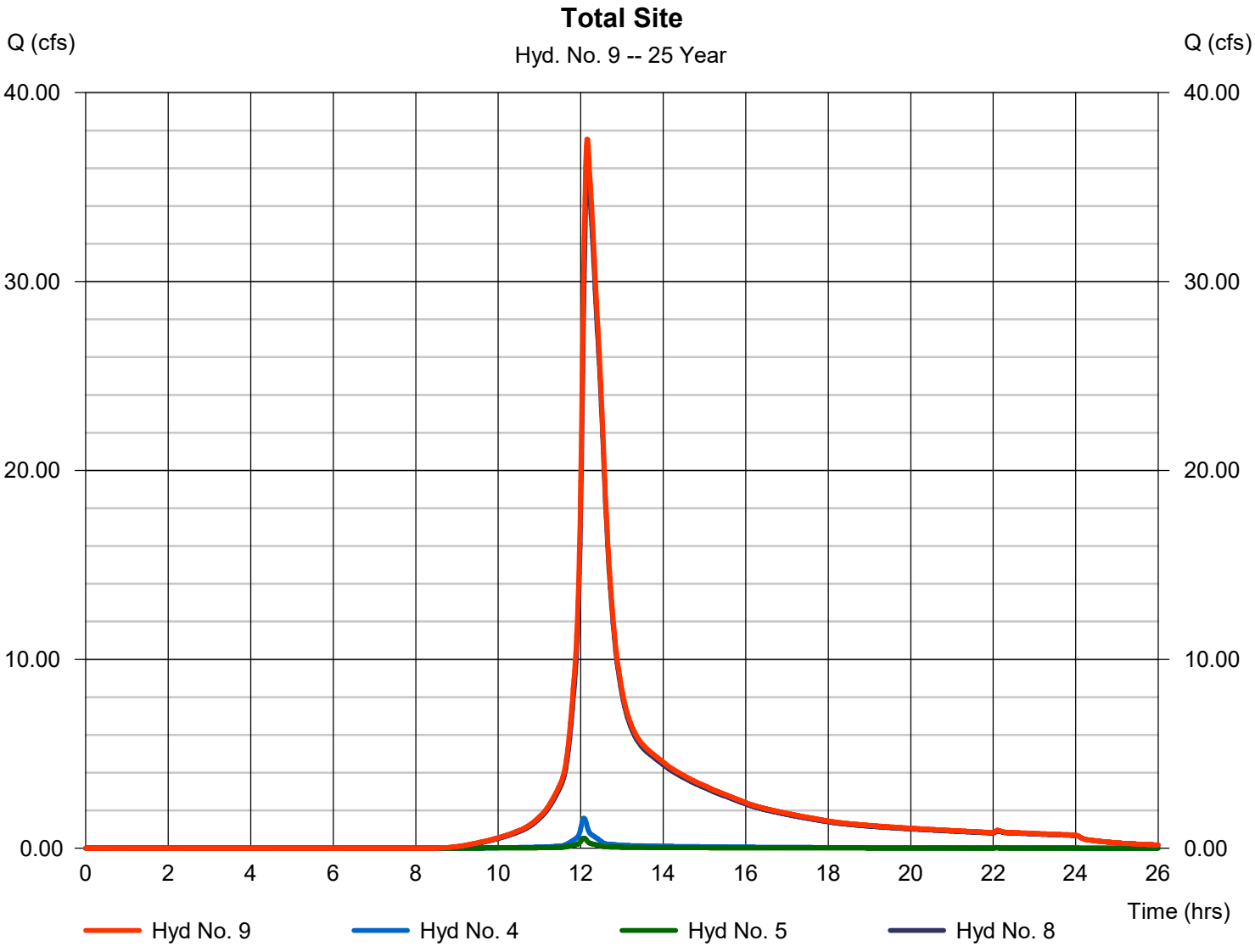


Hydrograph Report

Hyd. No. 9

Total Site

Hydrograph type	= Combine	Peak discharge	= 37.53 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.15 hrs
Time interval	= 1 min	Hyd. volume	= 188,382 cuft
Inflow hyds.	= 4, 5, 8	Contrib. drain. area	= 0.490 ac

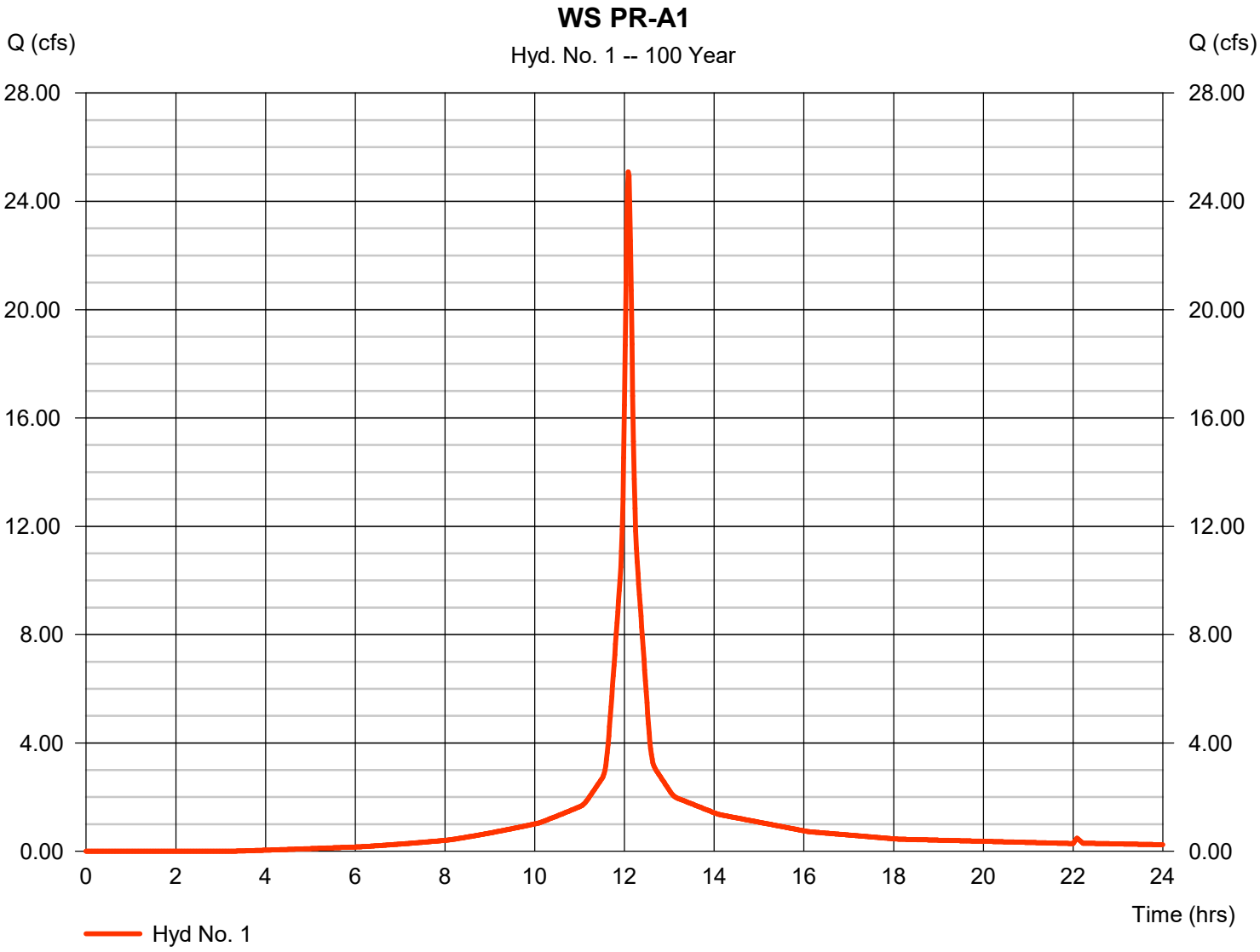


Hydrograph Report

Hyd. No. 1

WS PR-A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	25.08 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	85,448 cuft
Drainage area	=	3.440 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	8.00 min
Total precip.	=	8.46 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

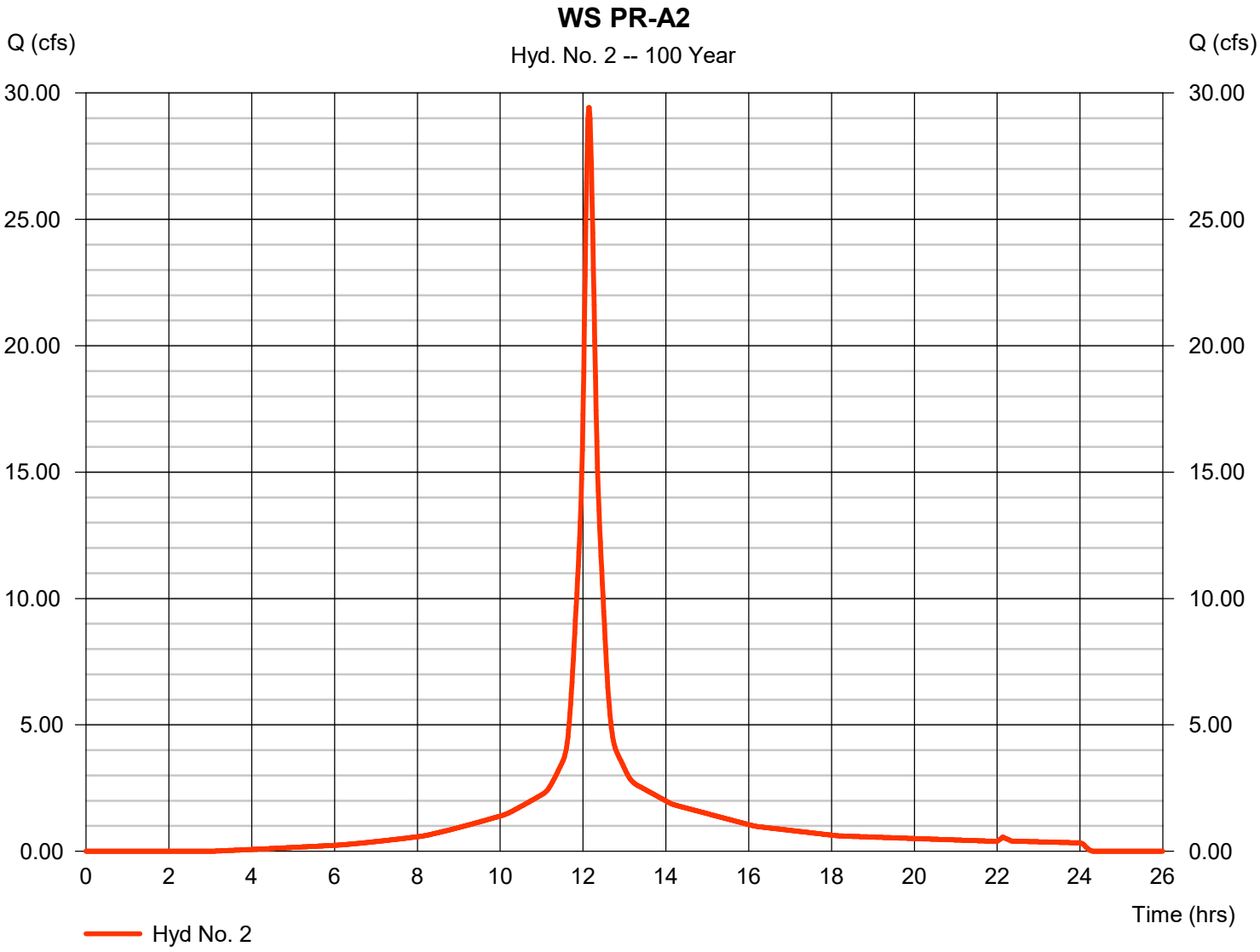


Hydrograph Report

Hyd. No. 2

WS PR-A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.43 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.13 hrs
Time interval	=	1 min	Hyd. volume	=	117,847 cuft
Drainage area	=	4.620 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	12.00 min
Total precip.	=	8.46 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

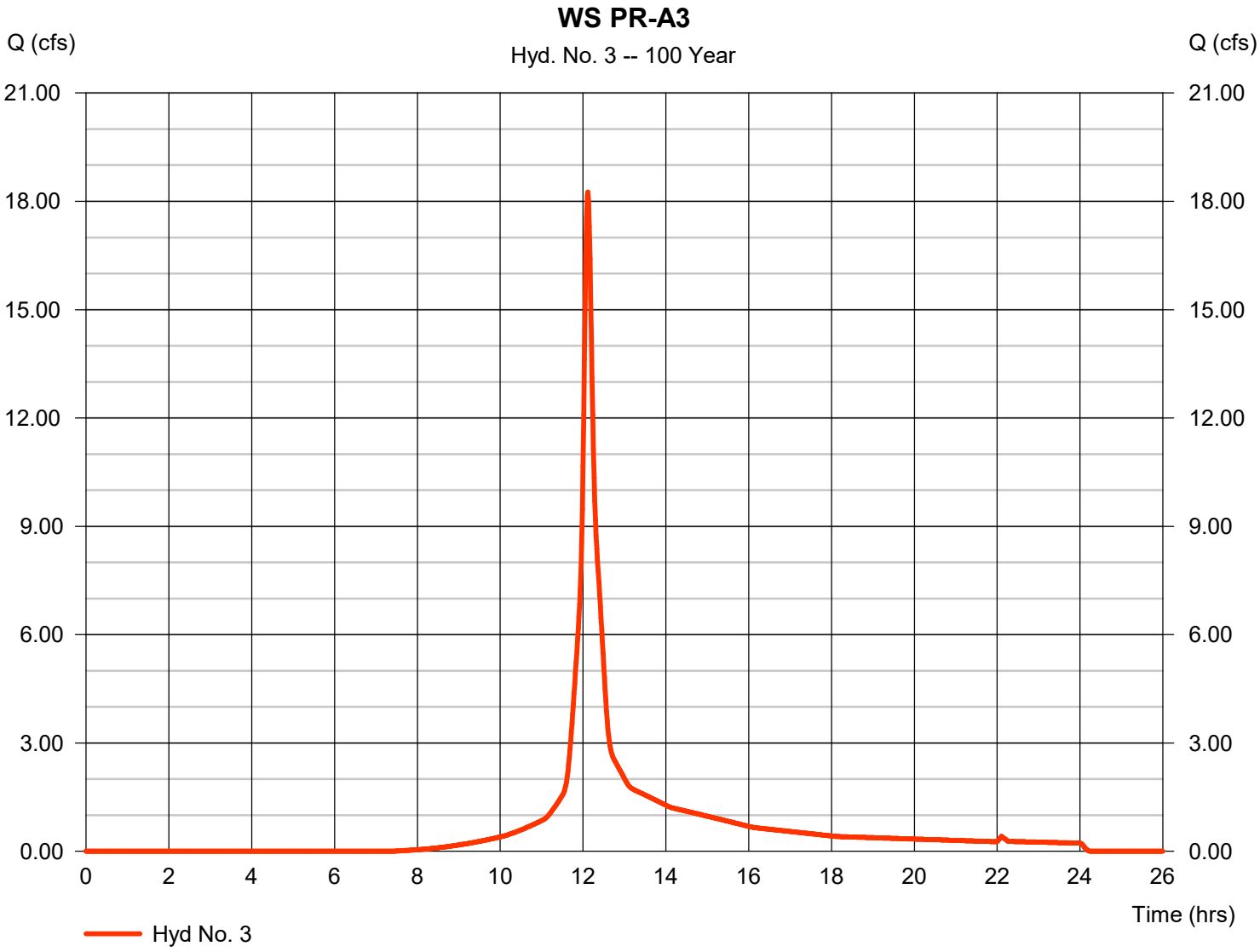


Hydrograph Report

Hyd. No. 3

WS PR-A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.26 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	62,562 cuft
Drainage area	=	3.460 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.46 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

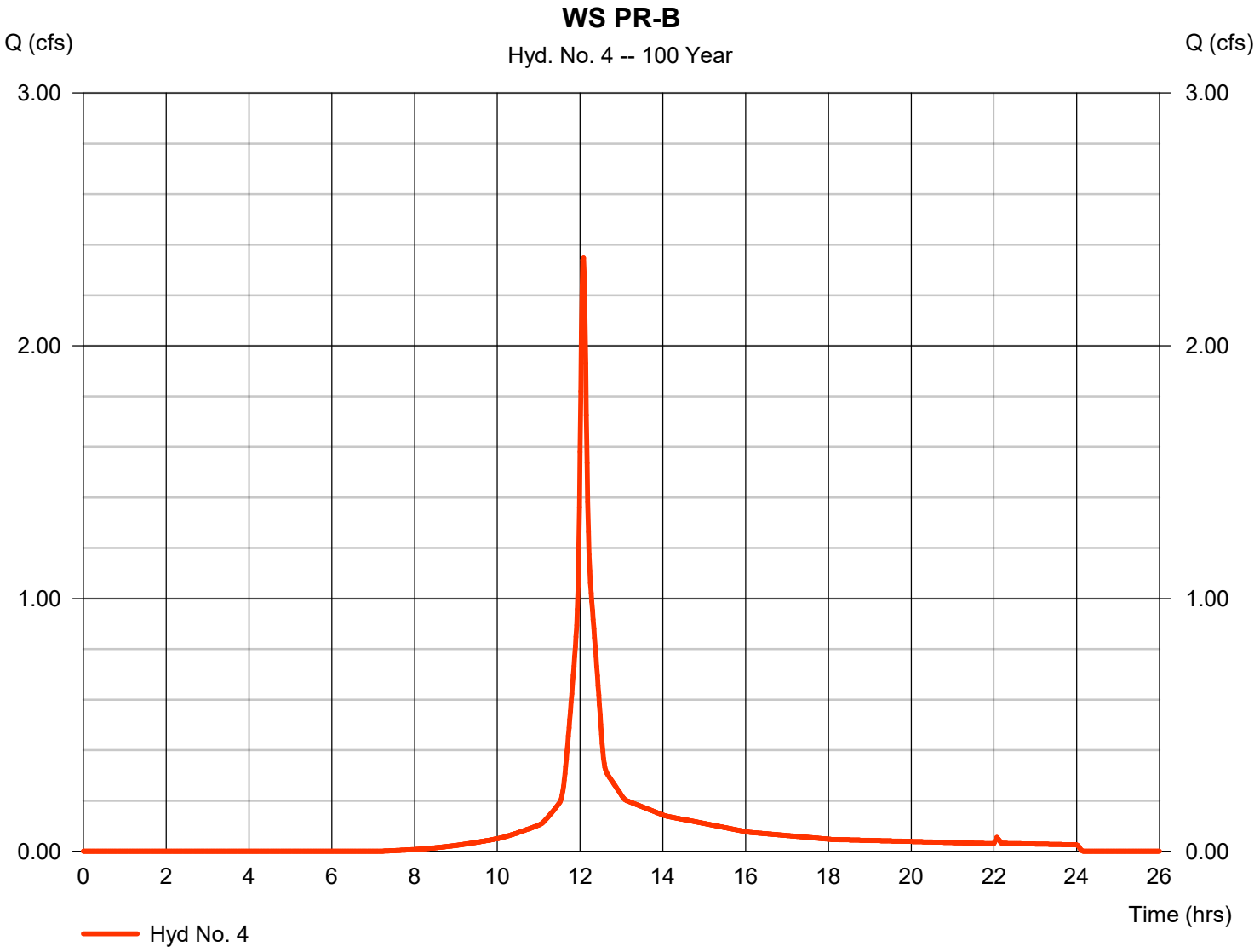


Hydrograph Report

Hyd. No. 4

WS PR-B

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.347 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	7,255 cuft
Drainage area	=	0.380 ac	Curve number	=	72
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.46 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

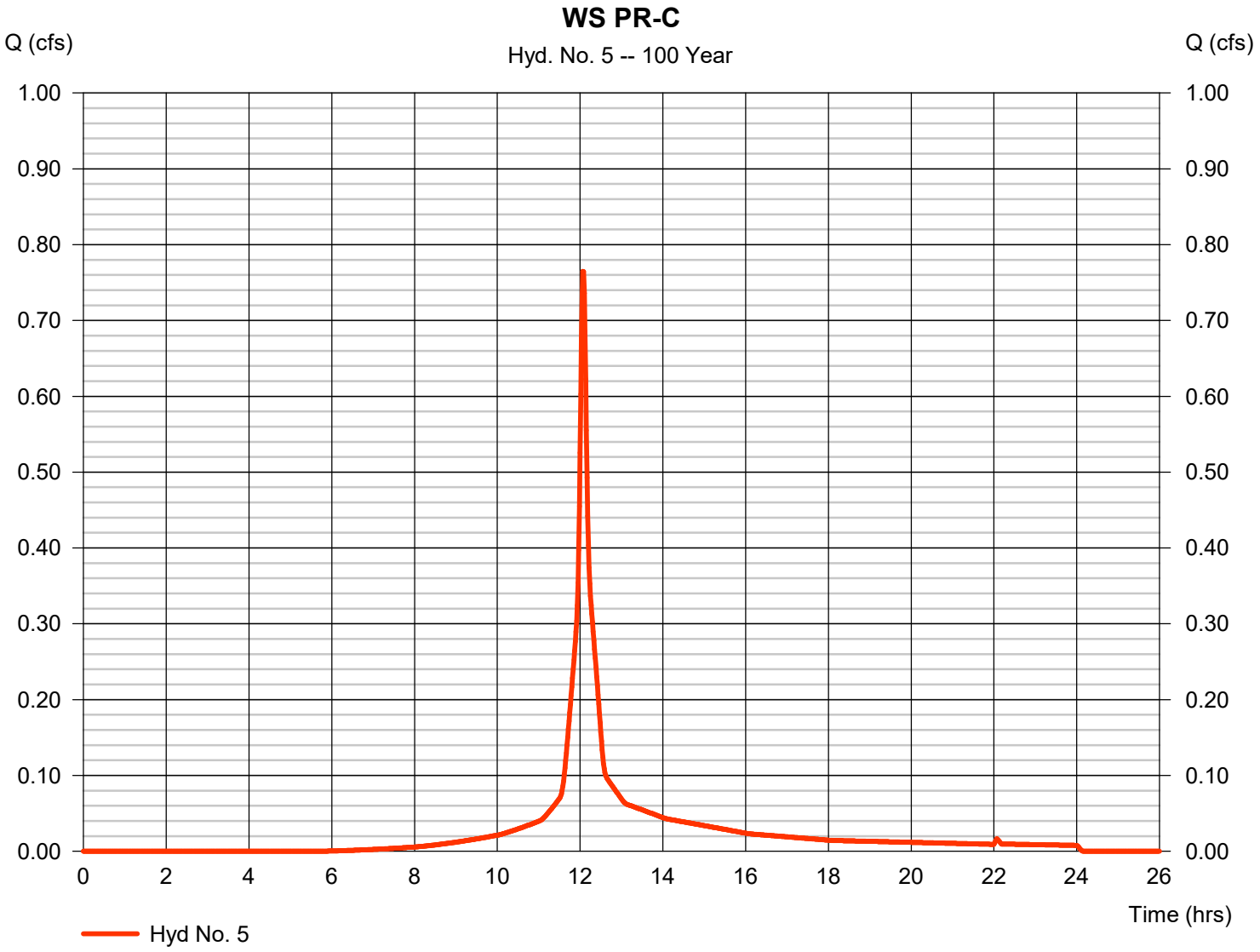


Hydrograph Report

Hyd. No. 5

WS PR-C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.765 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	1 min	Hyd. volume	=	2,396 cuft
Drainage area	=	0.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	8.46 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



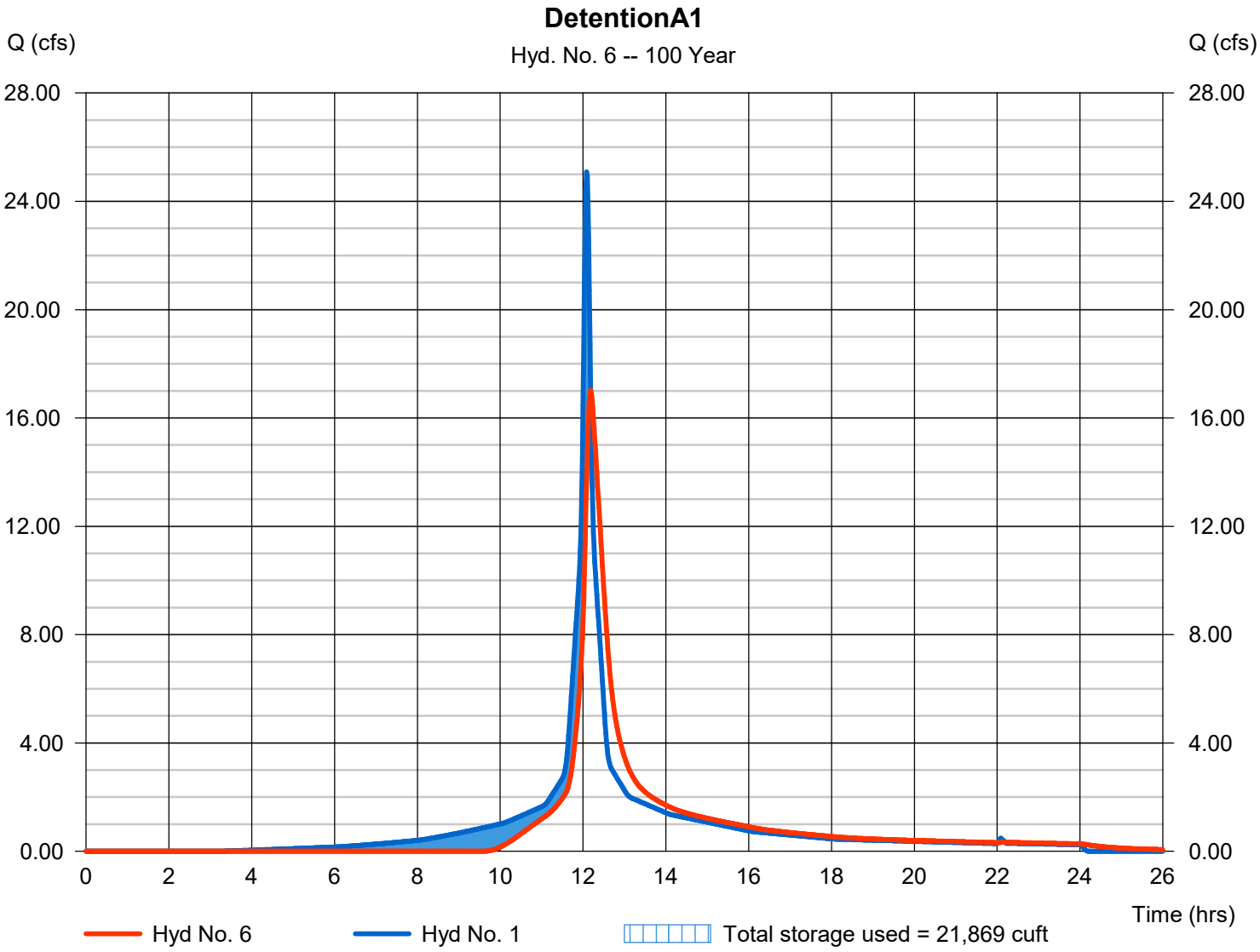
Hydrograph Report

Hyd. No. 6

DetentionA1

Hydrograph type	=	Reservoir	Peak discharge	=	17.02 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.18 hrs
Time interval	=	1 min	Hyd. volume	=	79,096 cuft
Inflow hyd. No.	=	1 - WS PR-A1	Max. Elevation	=	50.02 ft
Reservoir name	=	Underground Detention A1	Max. Storage	=	21,869 cuft

Storage Indication method used.



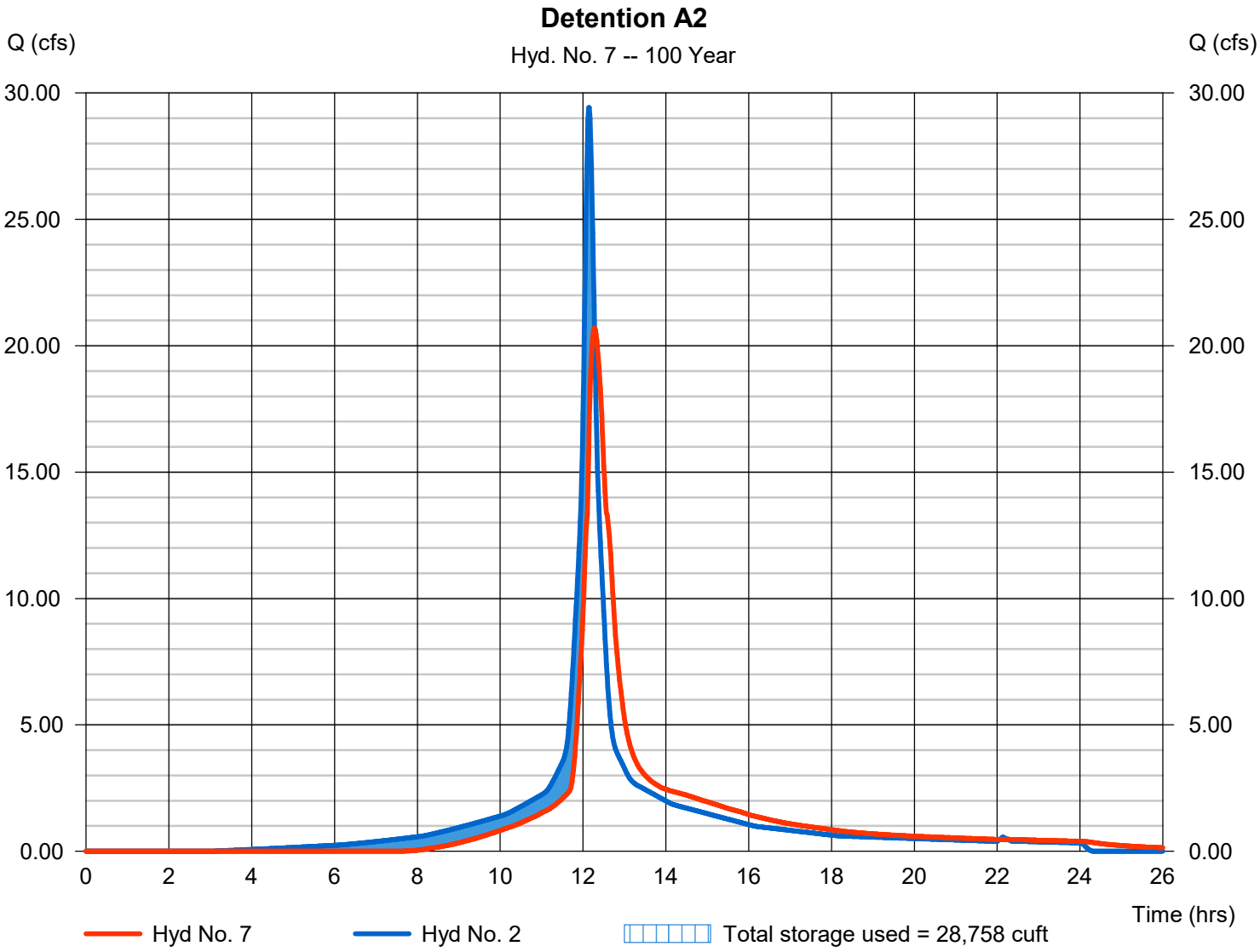
Hydrograph Report

Hyd. No. 7

Detention A2

Hydrograph type	= Reservoir	Peak discharge	= 20.70 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.28 hrs
Time interval	= 1 min	Hyd. volume	= 114,566 cuft
Inflow hyd. No.	= 2 - WS PR-A2	Max. Elevation	= 46.72 ft
Reservoir name	= Underground Detention A2	Max. Storage	= 28,758 cuft

Storage Indication method used.

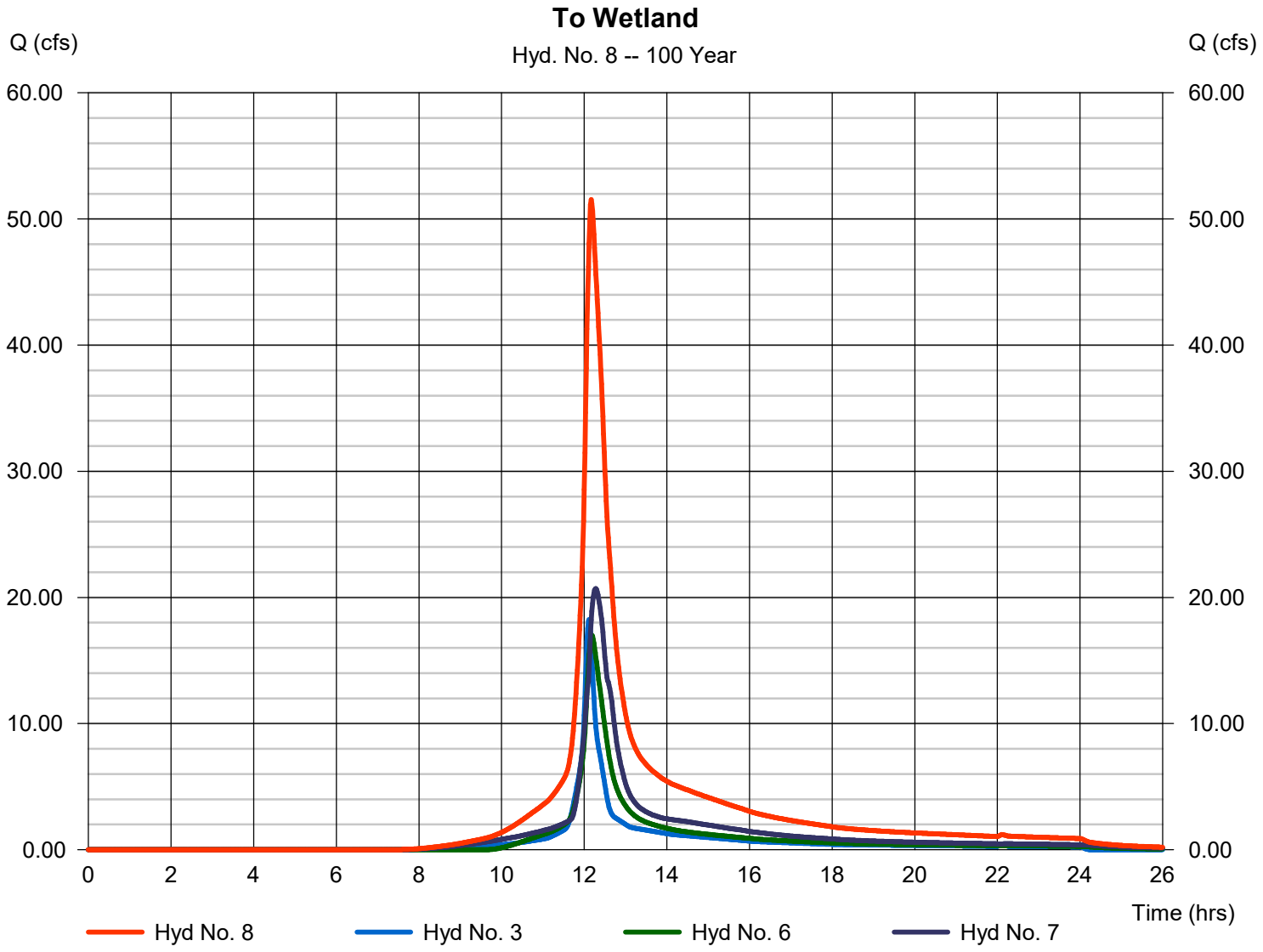


Hydrograph Report

Hyd. No. 8

To Wetland

Hydrograph type	= Combine	Peak discharge	= 51.54 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 1 min	Hyd. volume	= 256,225 cuft
Inflow hyds.	= 3, 6, 7	Contrib. drain. area	= 3.460 ac

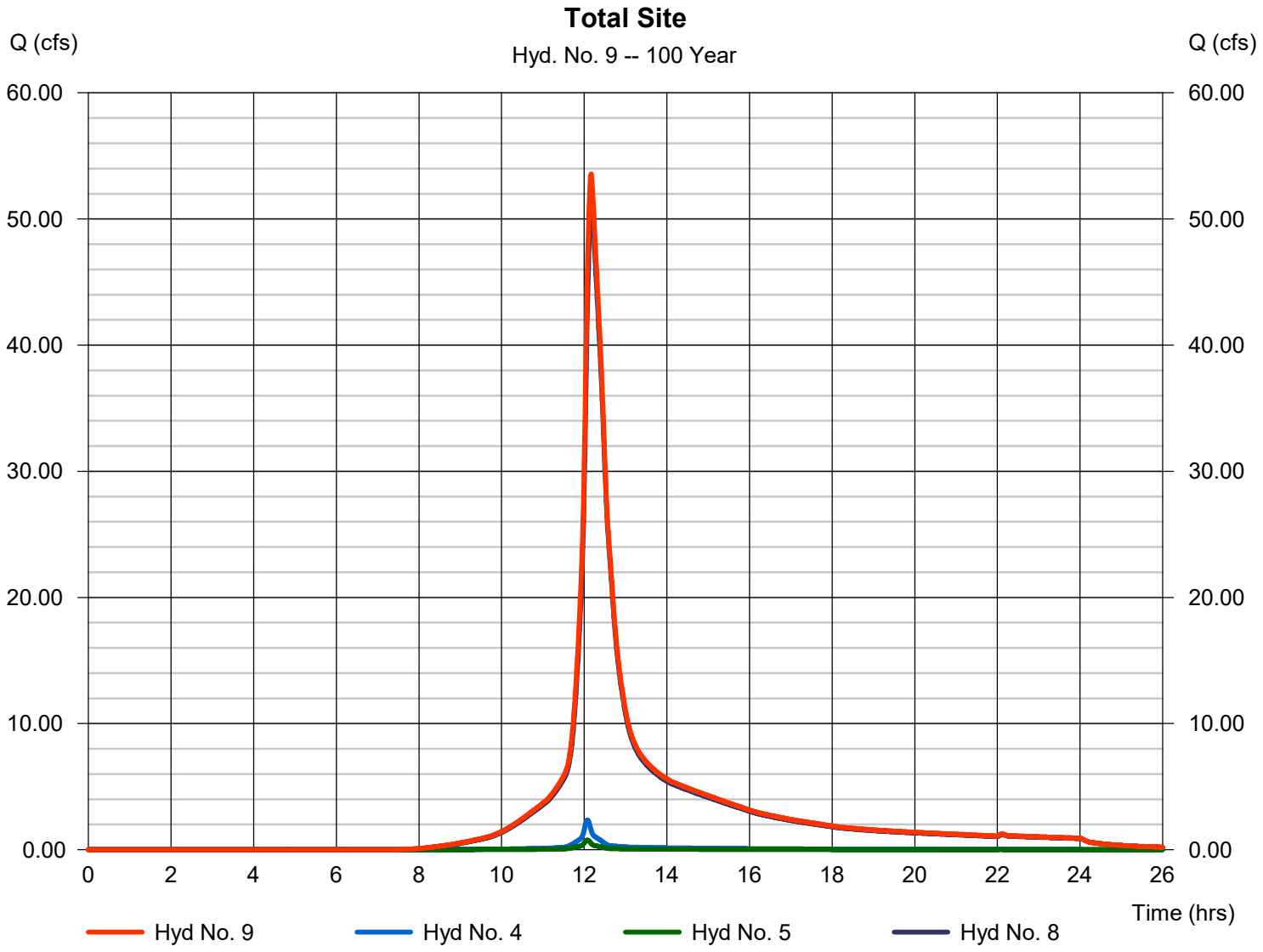


Hydrograph Report

Hyd. No. 9

Total Site

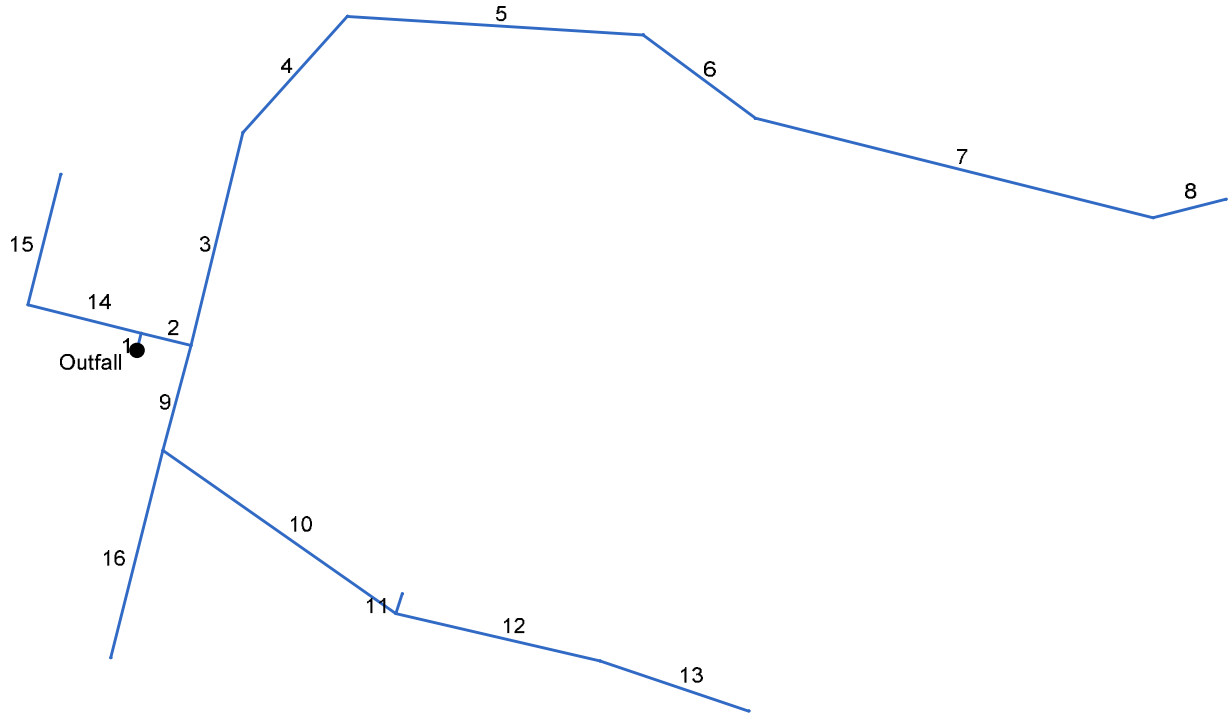
Hydrograph type	= Combine	Peak discharge	= 53.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 1 min	Hyd. volume	= 265,875 cuft
Inflow hyds.	= 4, 5, 8	Contrib. drain. area	= 0.490 ac



APPENDIX C

Stormwater Collection System Calculations

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Proposed North.stm	Number of lines: 16	Date: 12/6/2018

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	8.372	-76.281	MH	0.00	0.00	0.00	0.0	47.25	0.00	47.25	18	Cir	0.012	1.00	58.31	PIPE-39
2	1	24.237	90.372	MH	0.00	0.00	0.00	0.0	51.52	1.98	52.00	18	Cir	0.012	1.00	62.91	PIPE-37
3	2	104.046	-90.449	Genr	0.00	0.11	0.82	5.0	55.70	1.97	57.75	18	Cir	0.012	0.79	62.84	CCB204-CCB205
4	3	74.061	28.221	Genr	0.00	0.48	0.82	5.0	57.75	1.00	58.49	18	Cir	0.012	1.23	63.12	CCB205-CCB206
5	4	140.277	51.754	Genr	0.00	0.31	0.88	5.0	58.49	0.50	59.19	15	Cir	0.012	0.90	63.19	CCB206-CCB207
6	5	66.188	33.063	Genr	0.00	0.35	0.88	5.0	59.19	4.53	62.19	15	Cir	0.012	0.66	68.28	CCB207-CCB208
7	6	193.939	-22.593	Genr	0.00	0.40	0.83	5.0	62.19	1.45	65.00	15	Cir	0.012	0.80	69.00	CCB208-CCB209
8	7	35.650	-28.469	Genr	0.00	0.22	0.76	5.0	65.00	1.40	65.50	15	Cir	0.012	1.00	69.05	CCB209-CCB210
9	2	51.547	90.850	Genr	0.00	0.18	0.83	5.0	52.00	1.94	53.00	15	Cir	0.012	1.43	61.69	PIPE-36
10	9	134.701	-69.896	Genr	0.00	0.02	0.54	5.0	53.00	0.74	54.00	15	Cir	0.012	2.17	61.99	CCB211-YD213
11	10	9.877	-107.235	Genr	0.00	0.21	0.58	5.0	59.00	6.38	59.63	8	Cir	0.012	1.00	62.03	YD213-TRENCHDRAIN
12	10	99.081	-21.932	Genr	0.00	0.25	0.37	5.0	54.00	1.01	55.00	12	Cir	0.012	0.50	61.02	YD213-YD214
13	12	74.353	5.567	Genr	0.00	0.31	0.90	5.0	55.00	1.00	55.74	12	Cir	0.012	1.00	58.50	YD214-YD215
14	1	55.320	-89.638	Genr	0.00	0.15	0.77	5.0	51.80	2.17	53.00	15	Cir	0.012	1.50	56.84	DETIN-CCB203
15	14	63.909	89.982	Genr	0.00	0.16	0.89	5.0	53.00	4.54	55.90	15	Cir	0.012	1.00	58.46	CCB203-CCB204
16	9	101.392	-0.859	Genr	0.00	0.22	0.85	5.0	53.00	1.97	55.00	8	Cir	0.012	1.00	58.89	CCB211-CCB212

Project File: Proposed North.stm | Number of lines: 16 | Date: 12/6/2018

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-203	Manhole	58.31	Cir	0.00	0.00	18	Cir	47.25	18 15	Cir Cir	51.52 51.80
2	MH-206	Manhole	62.91	Cir	0.00	0.00	18	Cir	52.00	18 15	Cir Cir	55.70 52.00
3	CCB-207	Generic	62.84	Cir	0.00	0.00	18	Cir	57.75	18	Cir	57.75
4	CCB-208	Generic	63.12	Cir	0.00	0.00	18	Cir	58.49	15	Cir	58.49
5	CCB-209	Generic	63.19	Cir	0.00	0.00	15	Cir	59.19	15	Cir	59.19
6	CCB-210	Generic	68.28	Cir	0.00	0.00	15	Cir	62.19	15	Cir	62.19
7	CCB-211	Generic	69.00	Cir	0.00	0.00	15	Cir	65.00	15	Cir	65.00
8	CCB-212	Generic	69.05	Cir	0.00	0.00	15	Cir	65.50			
9	CCB-213	Generic	61.69	Cir	0.00	0.00	15	Cir	53.00	15 8	Cir Cir	53.00 53.00
10	YD-215	Generic	61.99	Cir	0.00	0.00	15	Cir	54.00	8 12	Cir Cir	59.00 54.00
11	TRENCH DRAIN	Generic	62.03	Cir	0.00	0.00	8	Cir	59.63			
12	YD-216	Generic	61.02	Cir	0.00	0.00	12	Cir	55.00	12	Cir	55.00
13	YD-217	Generic	58.50	Cir	0.00	0.00	12	Cir	55.74			
14	CCB-204	Generic	56.84	Cir	0.00	0.00	15	Cir	53.00	15	Cir	53.00
15	CCB-205	Generic	58.46	Cir	0.00	0.00	15	Cir	55.90			
16	CCB-214	Generic	58.89	Cir	0.00	0.00	8	Cir	55.00			

Project File: Proposed North.stm | Number of Structures: 16 | Run Date: 12/6/2018

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	PIPE-39	17.78	18	Cir	8.372	47.25	47.25	0.000	49.09*	49.30*	1.57	50.87	End	Manhole
2	PIPE-37	16.08	18	Cir	24.237	51.52	52.00	1.980	52.76	53.43	n/a	53.43	1	Manhole
3	CCB204-CCB205	10.54	18	Cir	104.046	55.70	57.75	1.970	56.59	59.00	n/a	59.00	2	Generic
4	CCB205-CCB206	10.00	18	Cir	74.061	57.75	58.49	0.999	59.00	59.71	n/a	59.71 j	3	Generic
5	CCB206-CCB207	7.44	15	Cir	140.277	58.49	59.19	0.499	59.74*	61.33*	0.51	61.84	4	Generic
6	CCB207-CCB208	5.61	15	Cir	66.188	59.19	62.19	4.533	61.84	63.15	n/a	63.15 j	5	Generic
7	CCB208-CCB209	3.58	15	Cir	193.939	62.19	65.00	1.449	63.15	65.76	n/a	65.76 j	6	Generic
8	CCB209-CCB210	1.21	15	Cir	35.650	65.00	65.50	1.403	65.76	65.93	n/a	65.93 j	7	Generic
9	PIPE-36	5.79	15	Cir	51.547	52.00	53.00	1.940	53.43	53.97	n/a	53.97 j	2	Generic
10	CCB211-YD213	3.55	15	Cir	134.701	53.00	54.00	0.742	53.97	54.76	n/a	54.76 j	9	Generic
11	YD213-TRENCHDRAIN	0.88	8	Cir	9.877	59.00	59.63	6.378	59.24	60.07	0.20	60.07	10	Generic
12	YD213-YD214	2.65	12	Cir	99.081	54.00	55.00	1.009	54.76	55.70	n/a	55.70 j	10	Generic
13	YD214-YD215	2.02	12	Cir	74.353	55.00	55.74	0.995	55.70	56.35	n/a	56.35 j	12	Generic
14	DETIN-CCB203	1.84	15	Cir	55.320	51.80	53.00	2.169	52.16	53.54	n/a	53.54	1	Generic
15	CCB203-CCB204	1.03	15	Cir	63.909	53.00	55.90	4.538	53.54	56.30	n/a	56.30 j	14	Generic
16	CCB211-CCB212	1.35	8	Cir	101.392	53.00	55.00	1.973	53.97	55.55	n/a	55.55 j	9	Generic

Project File: Proposed North.stm | Number of lines: 16 | Run Date: 12/6/2018

NOTES: Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	8.372	0.00	3.37	0.00	0.00	2.66	0.0	7.1	6.7	17.78	0.00	10.06	18	0.00	47.25	47.25	49.09	49.30	58.08	58.31	PIPE-39
2	1	24.237	0.00	3.06	0.00	0.00	2.40	0.0	7.1	6.7	16.08	16.01	9.80	18	1.98	51.52	52.00	52.76	53.43	58.31	62.91	PIPE-37
3	2	104.046	0.11	1.87	0.82	0.09	1.56	5.0	6.8	6.7	10.54	15.97	8.18	18	1.97	55.70	57.75	56.59	59.00	62.91	62.84	CCB204-CCB205
4	3	74.061	0.48	1.76	0.82	0.39	1.47	5.0	6.7	6.8	10.00	11.37	6.44	18	1.00	57.75	58.49	59.00	59.71	62.84	63.12	CCB205-CCB206
5	4	140.277	0.31	1.28	0.88	0.27	1.08	5.0	6.3	6.9	7.44	4.94	6.06	15	0.50	58.49	59.19	59.74	61.33	63.12	63.19	CCB206-CCB207
6	5	66.188	0.35	0.97	0.88	0.31	0.81	5.0	6.0	6.9	5.61	14.89	5.06	15	4.53	59.19	62.19	61.84	63.15	63.19	68.28	CCB207-CCB208
7	6	193.939	0.40	0.62	0.83	0.33	0.50	5.0	5.3	7.2	3.58	8.42	4.05	15	1.45	62.19	65.00	63.15	65.76	68.28	69.00	CCB208-CCB209
8	7	35.650	0.22	0.22	0.76	0.17	0.17	5.0	5.0	7.2	1.21	8.28	2.37	15	1.40	65.00	65.50	65.76	65.93	69.00	69.05	CCB209-CCB210
9	2	51.547	0.18	1.19	0.83	0.15	0.84	5.0	6.3	6.9	5.79	9.74	5.18	15	1.94	52.00	53.00	53.43	53.97	62.91	61.69	PIPE-36
10	9	134.701	0.02	0.79	0.54	0.01	0.50	5.0	5.7	7.0	3.55	6.03	4.00	15	0.74	53.00	54.00	53.97	54.76	61.69	61.99	CCB211-YD213
11	10	9.877	0.21	0.21	0.58	0.12	0.12	5.0	5.0	7.2	0.88	3.30	5.79	8	6.38	59.00	59.63	59.24	60.07	61.99	62.03	YD213-TRENCH
12	10	99.081	0.25	0.56	0.37	0.09	0.37	5.0	5.3	7.1	2.65	3.88	4.34	12	1.01	54.00	55.00	54.76	55.70	61.99	61.02	YD213-YD214
13	12	74.353	0.31	0.31	0.90	0.28	0.28	5.0	5.0	7.2	2.02	3.85	3.75	12	1.00	55.00	55.74	55.70	56.35	61.02	58.50	YD214-YD215
14	1	55.320	0.15	0.31	0.77	0.12	0.26	5.0	5.4	7.1	1.84	10.30	4.98	15	2.17	51.80	53.00	52.16	53.54	58.31	56.84	DETIN-CCB203
15	14	63.909	0.16	0.16	0.89	0.14	0.14	5.0	5.0	7.2	1.03	14.90	2.55	15	4.54	53.00	55.90	53.54	56.30	56.84	58.46	CCB203-CCB204
16	9	101.392	0.22	0.22	0.85	0.19	0.19	5.0	5.0	7.2	1.35	1.84	4.14	8	1.97	53.00	55.00	53.97	55.55	61.69	58.89	CCB211-CCB212

Project File: Proposed North.stm

Number of lines: 16

Run Date: 12/6/2018

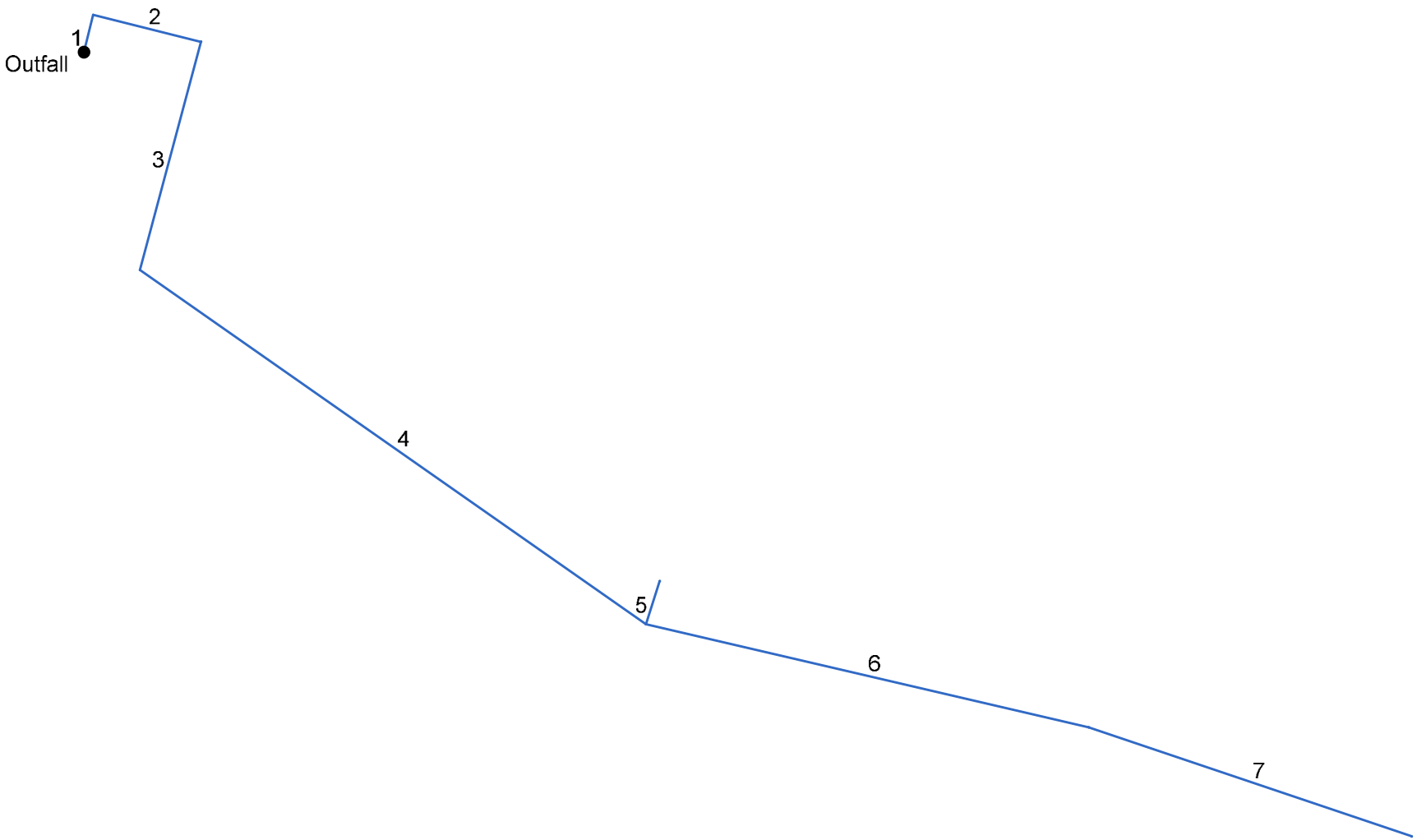
NOTES:Intensity = 88.24 / (Inlet time + 15.50) ^ 0.83; Return period =Yrs. 10 ; c = cir e = ellip b = box

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	PIPE-39	User																		0.00
2	PIPE-37	User																		0.00
3	CCB204-CCB205	User																		5.00
4	CCB205-CCB206	User																		5.00
5	CCB206-CCB207	User																		5.00
6	CCB207-CCB208	User																		5.00
7	CCB208-CCB209	User																		5.00
8	CCB209-CCB210	User																		5.00
9	PIPE-36	User																		5.00
10	CCB211-YD213	User																		5.00
11	YD213-TRENCH	User																		5.00
12	YD213-YD214	User																		5.00
13	YD214-YD215	User																		5.00
14	DETIN-CCB203	User																		5.00
15	CCB203-CCB204	User																		5.00
16	CCB211-CCB212	User																		5.00

Project File: Proposed North.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 16 | Date: 12/6/2018

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: 100yr Yard Drain.stm	Number of lines: 7	Date: 12/6/2018

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	8.372	-76.281	MH	0.00	0.00	0.00	0.0	47.25	0.00	47.25	18	Cir	0.012	1.00	58.31	PIPE-39
2	1	24.237	90.372	MH	0.00	0.00	0.00	0.0	51.52	1.98	52.00	18	Cir	0.012	1.00	62.91	PIPE-37
3	2	51.547	90.850	Genr	0.00	0.18	0.83	5.0	52.00	1.94	53.00	15	Cir	0.012	1.43	61.69	PIPE-36
4	3	134.701	-69.896	Genr	0.00	0.02	0.54	5.0	53.00	0.74	54.00	15	Cir	0.012	1.50	61.99	CCB211-YD213
5	4	9.877	-107.235	Genr	0.00	0.21	0.58	5.0	59.00	6.38	59.63	8	Cir	0.012	1.00	62.03	YD213-TRENCHDRAIN
6	4	99.081	-21.932	Genr	0.00	0.25	0.37	5.0	54.00	1.01	55.00	12	Cir	0.012	0.50	61.02	YD213-YD214
7	6	74.353	5.567	Genr	0.00	0.31	0.90	5.0	55.00	1.00	55.74	12	Cir	0.012	1.00	58.50	YD214-YD215

Project File: 100yr Yard Drain.stm

Number of lines: 7

Date: 12/6/2018

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	MH-203	Manhole	58.31	Cir	0.00	0.00	18	Cir	47.25	18	Cir	51.52
2	MH-206	Manhole	62.91	Cir	0.00	0.00	18	Cir	52.00	15	Cir	52.00
3	CCB-213	Generic	61.69	Cir	0.00	0.00	15	Cir	53.00	15	Cir	53.00
4	YD-215	Generic	61.99	Cir	0.00	0.00	15	Cir	54.00	8 12	Cir Cir	59.00 54.00
5	TRENCH DRAIN	Generic	62.03	Cir	0.00	0.00	8	Cir	59.63			
6	YD-216	Generic	61.02	Cir	0.00	0.00	12	Cir	55.00	12	Cir	55.00
7	YD-217	Generic	58.50	Cir	0.00	0.00	12	Cir	55.74			

Project File: 100yr Yard Drain.stm | Number of Structures: 7 | Run Date: 12/6/2018

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	PIPE-39	6.15	18	Cir	8.372	47.25	47.25	0.000	50.02*	50.04*	0.19	50.23	End	Manhole
2	PIPE-37	6.16	18	Cir	24.237	51.52	52.00	1.980	52.17	52.96	0.42	52.96	1	Manhole
3	PIPE-36	6.19	15	Cir	51.547	52.00	53.00	1.940	52.96	54.00	0.76	54.00	2	Generic
4	CCB211-YD213	4.85	15	Cir	134.701	53.00	54.00	0.742	54.00	54.89	n/a	54.89 j	3	Generic
5	YD213-TRENCHDRAIN	1.20	8	Cir	9.877	59.00	59.63	6.378	59.28	60.15	0.26	60.15	4	Generic
6	YD213-YD214	3.62	12	Cir	99.081	54.00	55.00	1.009	54.89	55.81	n/a	55.81 j	4	Generic
7	YD214-YD215	2.74	12	Cir	74.353	55.00	55.74	0.995	55.81	56.45	n/a	56.45 j	6	Generic

Project File: 100yr Yard Drain.stm | Number of lines: 7 | Run Date: 12/6/2018

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	8.372	0.00	0.97	0.00	0.00	0.65	0.0	6.3	9.4	6.15	0.00	3.48	18	0.00	47.25	47.25	50.02	50.04	58.08	58.31	PIPE-39
2	1	24.237	0.00	0.97	0.00	0.00	0.65	0.0	6.2	9.4	6.16	16.01	6.81	18	1.98	51.52	52.00	52.17	52.96	58.31	62.91	PIPE-37
3	2	51.547	0.18	0.97	0.83	0.15	0.65	5.0	6.1	9.5	6.19	9.74	6.00	15	1.94	52.00	53.00	52.96	54.00	62.91	61.69	PIPE-36
4	3	134.701	0.02	0.79	0.54	0.01	0.50	5.0	5.6	9.6	4.85	6.03	4.88	15	0.74	53.00	54.00	54.00	54.89	61.69	61.99	CCB211-YD213
5	4	9.877	0.21	0.21	0.58	0.12	0.12	5.0	5.0	9.8	1.20	3.30	6.41	8	6.38	59.00	59.63	59.28	60.15	61.99	62.03	YD213-TRENCH
6	4	99.081	0.25	0.56	0.37	0.09	0.37	5.0	5.3	9.7	3.62	3.88	5.09	12	1.01	54.00	55.00	54.89	55.81	61.99	61.02	YD213-YD214
7	6	74.353	0.31	0.31	0.90	0.28	0.28	5.0	5.0	9.8	2.74	3.85	4.31	12	1.00	55.00	55.74	55.81	56.45	61.02	58.50	YD214-YD215

Project File: 100yr Yard Drain.stm

Number of lines: 7

Run Date: 12/6/2018

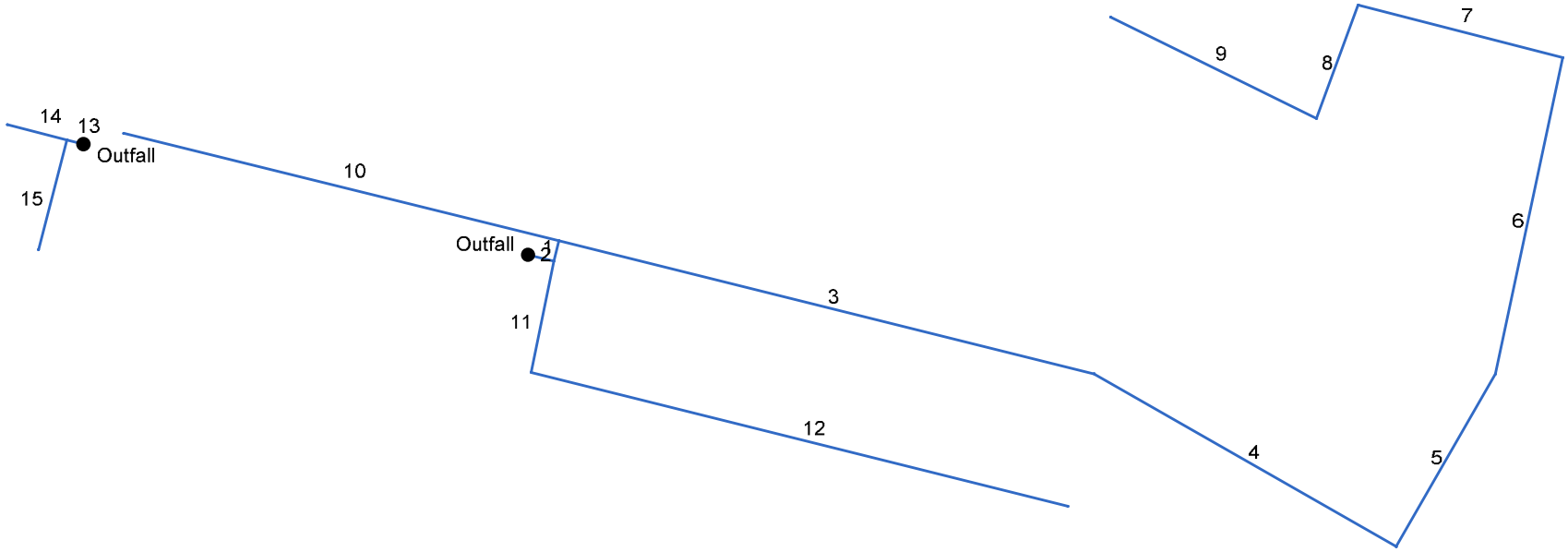
NOTES:Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period =Yrs. 100 ; c = cir e = ellip b = box

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	PIPE-39	User																		0.00
2	PIPE-37	User																		0.00
3	PIPE-36	User																		5.00
4	CCB211-YD213	User																		5.00
5	YD213-TRENCH	User																		5.00
6	YD213-YD214	User																		5.00
7	YD214-YD215	User																		5.00

Project File: 100yr Yard Drain.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 7 | Date: 12/6/2018

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Proposed South.stm	Number of lines: 15	Date: 12/6/2018

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	12.811	14.081	MH	0.00	0.00	0.00	0.0	43.75	0.00	43.75	24	Cir	0.012	1.00	49.66	MH107-MH108
2	1	10.306	-90.000	Genr	0.00	0.75	0.87	5.0	43.75	0.97	43.85	18	Cir	0.012	2.25	50.97	MH103-CCB110
3	2	266.487	90.010	Genr	0.00	0.65	0.84	5.0	43.85	0.87	46.16	18	Cir	0.012	0.50	51.20	CCB10-CCB12
4	3	168.528	15.855	Genr	0.00	0.11	0.55	5.0	46.16	0.50	47.00	15	Cir	0.012	1.50	51.79	CCB112-CCB113
5	4	96.737	-90.268	Genr	0.00	0.50	0.73	5.0	47.00	1.03	48.00	12	Cir	0.012	0.53	54.26	CCB113-YD-114
6	5	157.470	-17.733	Genr	0.00	0.17	0.31	5.0	48.00	1.27	50.00	10	Cir	0.012	1.50	62.60	YD114-YD115
7	6	102.120	-87.427	Genr	0.00	0.32	0.34	5.0	50.00	1.96	52.00	10	Cir	0.012	1.49	63.82	YD115-YD116
8	7	58.713	-84.473	Genr	0.00	0.12	0.35	5.0	52.00	2.90	53.70	8	Cir	0.012	1.50	59.50	YD117-YD116
9	8	111.093	96.318	Genr	0.00	0.17	0.42	5.0	53.70	0.54	54.30	8	Cir	0.012	1.00	57.00	EXYD-YD117
10	2	216.758	-90.119	Genr	0.00	0.26	0.78	5.0	44.83	1.00	47.00	12	Cir	0.012	1.00	50.56	DETIN104-CCB105
11	1	55.248	87.309	Genr	0.00	0.39	0.87	5.0	43.75	0.45	44.00	18	Cir	0.012	1.50	48.57	MH108-CCB109
12	11	267.401	-87.273	Genr	0.00	0.49	0.86	5.0	44.00	0.67	45.80	15	Cir	0.012	1.00	49.03	MH108-CB-111
13	End	8.263	-165.607	MH	0.00	0.00	0.00	0.0	43.75	0.00	43.75	15	Cir	0.012	1.00	49.20	PIPE-40
14	13	29.671	0.095	Genr	0.00	0.45	0.80	5.0	44.70	1.01	45.00	12	Cir	0.012	1.00	48.92	CCB106-CCB105
15	13	55.220	-90.000	Genr	0.00	0.24	0.84	5.0	43.75	0.81	44.20	12	Cir	0.012	1.00	47.43	CCB103-DET IN

Project File: Proposed South.stm

Number of lines: 15

Date: 12/6/2018

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	STM MH-107	Manhole	49.66	Cir	0.00	0.00	24	Cir	43.75	18 18	Cir Cir	43.75 43.75
2	CCB-110	Generic	50.97	Cir	0.00	0.00	18	Cir	43.85	18 12	Cir Cir	43.85 44.83
3	CCB-112	Generic	51.20	Cir	0.00	0.00	18	Cir	46.16	15	Cir	46.16
4	CCB-113	Generic	51.79	Cir	0.00	0.00	15	Cir	47.00	12	Cir	47.00
5	YD-114	Generic	54.26	Cir	0.00	0.00	12	Cir	48.00	10	Cir	48.00
6	YD-115	Generic	62.60	Cir	0.00	0.00	10	Cir	50.00	10	Cir	50.00
7	YD-116	Generic	63.82	Cir	0.00	0.00	10	Cir	52.00	8	Cir	52.00
8	YD-117	Generic	59.50	Cir	0.00	0.00	8	Cir	53.70	8	Cir	53.70
9	CONNECT TO EX YD	Generic	57.00	Cir	0.00	0.00	8	Cir	54.30			
10	CCB-111	Generic	50.56	Cir	0.00	0.00	12	Cir	47.00			
11	CCB-108	Generic	48.57	Cir	0.00	0.00	18	Cir	44.00	15	Cir	44.00
12	CCB-109	Generic	49.03	Cir	0.00	0.00	15	Cir	45.80			
13	MH-103	Manhole	49.20	Cir	0.00	0.00	15	Cir	43.75	12 12	Cir Cir	44.70 43.75
14	CCB-105.	Generic	48.92	Cir	0.00	0.00	12	Cir	45.00			
15	CCB-104	Generic	47.43	Cir	0.00	0.00	12	Cir	44.20			

Project File: Proposed South.stm | Number of Structures: 15 | Run Date: 12/6/2018

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	MH107-MH108	17.48	24	Cir	12.811	43.75	43.75	0.000	45.57	45.66	0.50	46.15	End	Manhole
2	MH103-CCB110	12.84	18	Cir	10.306	43.75	43.85	0.970	46.15*	46.29*	1.85	48.13	1	Generic
3	CCB10-CCB12	7.87	18	Cir	266.487	43.85	46.16	0.867	48.13*	49.41*	0.15	49.56	2	Generic
4	CCB112-CCB113	4.54	15	Cir	168.528	46.16	47.00	0.498	49.56*	50.28*	0.32	50.59	3	Generic
5	CCB113-YD-114	4.19	12	Cir	96.737	47.00	48.00	1.034	50.59*	51.74*	0.23	51.97	4	Generic
6	YD114-YD115	1.85	10	Cir	157.470	48.00	50.00	1.270	51.97*	52.93*	0.27	53.20	5	Generic
7	YD115-YD116	1.53	10	Cir	102.120	50.00	52.00	1.958	53.20*	53.63*	0.18	53.81	6	Generic
8	YD117-YD116	0.79	8	Cir	58.713	52.00	53.70	2.895	53.81	54.12	n/a	54.12 j	7	Generic
9	EXYD-YD117	0.52	8	Cir	111.093	53.70	54.30	0.540	54.12	54.64	n/a	54.64	8	Generic
10	DETIN104-CCB105	1.47	12	Cir	216.758	44.83	47.00	1.001	48.13*	48.45*	0.05	48.50	2	Generic
11	MH108-CCB109	5.14	18	Cir	55.248	43.75	44.00	0.453	46.15*	46.27*	0.20	46.46	1	Generic
12	MH108-CB-111	3.05	15	Cir	267.401	44.00	45.80	0.673	46.46	46.93	0.11	47.04	11	Generic
13	PIPE-40	3.99	15	Cir	8.263	43.75	43.75	0.000	45.57*	45.60*	0.16	45.76	End	Manhole
14	CCB106-CCB105	2.61	12	Cir	29.671	44.70	45.00	1.011	45.76	45.86	0.21	46.06	13	Generic
15	CCB103-DET IN	1.46	12	Cir	55.220	43.75	44.20	0.815	45.76*	45.84*	0.05	45.89	13	Generic

Project File: Proposed South.stm | Number of lines: 15 | Run Date: 12/6/2018

NOTES: Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	12.811	0.00	3.93	0.00	0.00	2.86	0.0	9.7	6.1	17.48	0.00	5.74	24	0.00	43.75	43.75	45.57	45.66	49.80	49.66	MH107-MH108
2	1	10.306	0.75	3.05	0.87	0.65	2.10	5.0	9.7	6.1	12.84	11.21	7.27	18	0.97	43.75	43.85	46.15	46.29	49.66	50.97	MH103-CCB110
3	2	266.487	0.65	2.04	0.84	0.55	1.25	5.0	8.7	6.3	7.87	10.59	4.46	18	0.87	43.85	46.16	48.13	49.41	50.97	51.20	CCB10-CCB12
4	3	168.528	0.11	1.39	0.55	0.06	0.70	5.0	7.9	6.5	4.54	4.94	3.70	15	0.50	46.16	47.00	49.56	50.28	51.20	51.79	CCB112-CCB113
5	4	96.737	0.50	1.28	0.73	0.37	0.64	5.0	7.6	6.6	4.19	3.92	5.34	12	1.03	47.00	48.00	50.59	51.74	51.79	54.26	CCB113-YD-114
6	5	157.470	0.17	0.78	0.31	0.05	0.27	5.0	6.8	6.7	1.85	2.67	3.40	10	1.27	48.00	50.00	51.97	52.93	54.26	62.60	YD114-YD115
7	6	102.120	0.32	0.61	0.34	0.11	0.22	5.0	6.2	6.9	1.53	3.32	2.81	10	1.96	50.00	52.00	53.20	53.63	62.60	63.82	YD115-YD116
8	7	58.713	0.12	0.29	0.35	0.04	0.11	5.0	5.9	7.0	0.79	2.23	2.84	8	2.90	52.00	53.70	53.81	54.12	63.82	59.50	YD117-YD116
9	8	111.093	0.17	0.17	0.42	0.07	0.07	5.0	5.0	7.2	0.52	0.96	2.58	8	0.54	53.70	54.30	54.12	54.64	59.50	57.00	EXYD-YD117
10	2	216.758	0.26	0.26	0.78	0.20	0.20	5.0	5.0	7.2	1.47	3.86	1.87	12	1.00	44.83	47.00	48.13	48.45	50.97	50.56	DETIN104-CCB10
11	1	55.248	0.39	0.88	0.87	0.34	0.76	5.0	6.8	6.8	5.14	7.65	2.91	18	0.45	43.75	44.00	46.15	46.27	49.66	48.57	MH108-CCB109
12	11	267.401	0.49	0.49	0.86	0.42	0.42	5.0	5.0	7.2	3.05	5.74	2.55	15	0.67	44.00	45.80	46.46	46.93	48.57	49.03	MH108-CB-111
13	End	8.263	0.00	0.69	0.00	0.00	0.56	0.0	5.5	7.1	3.99	0.00	3.25	15	0.00	43.75	43.75	45.57	45.60	49.20	49.20	PIPE-40
14	13	29.671	0.45	0.45	0.80	0.36	0.36	5.0	5.0	7.2	2.61	3.88	3.48	12	1.01	44.70	45.00	45.76	45.86	49.20	48.92	CCB106-CCB105
15	13	55.220	0.24	0.24	0.84	0.20	0.20	5.0	5.0	7.2	1.46	3.48	1.86	12	0.81	43.75	44.20	45.76	45.84	49.20	47.43	CCB103-DET IN

Project File: Proposed South.stm | Number of lines: 15 | Run Date: 12/6/2018

NOTES:Intensity = 88.24 / (Inlet time + 15.50) ^ 0.83; Return period =Yrs. 10 ; c = cir e = ellip b = box

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	MH107-MH108	User																		0.00
2	MH103-CCB110	User																		5.00
3	CCB10-CCB12	User																		5.00
4	CCB112-CCB113	User																		5.00
5	CCB113-YD-114	User																		5.00
6	YD114-YD115	User																		5.00
7	YD115-YD116	User																		5.00
8	YD117-YD116	User																		5.00
9	EXYD-YD117	User																		5.00
10	DETIN104-CCB10	User																		5.00
11	MH108-CCB109	User																		5.00
12	MH108-CB-111	User																		5.00
13	PIPE-40	User																		0.00
14	CCB106-CCB105	User																		5.00
15	CCB103-DET IN	User																		5.00

Project File: Proposed South.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 15 | Date: 12/6/2018

Project **ONE PARK** By **RJS** Date **12/3/2018**

Location **WEST HARTFORD CT** Checked **NLK** Date **12/3/2018**

Circle one: Present (Developed) Job No. **140165301**

1. Rational 'C' Runoff Coefficient & Area Calculations

Catchment Area	Total Area		Impervious (C=.9)		Pervious (C=0.3)		Percent Impervious	C
	SF	AC	SF	AC	SF	AC		
CCB-104	10,597	0.24	9,574	0.22	1,023	0.02	90%	0.84
CCB-105	19,692	0.45	16,476	0.38	3,216	0.07	84%	0.80
CCB-108	16,659	0.38	15,746	0.36	913	0.02	95%	0.87
CCB-109	21,349	0.49	19,873	0.46	1,476	0.03	93%	0.86
CCB-110 (WITH ROOF)	32,484	0.75	31,098	0.71	1,385	0.03	96%	0.87
CCB-111	11,464	0.26	9,146	0.21	2,318	0.05	80%	0.78
CCB-112 (WITH ROOF)	28,524	0.65	25,514	0.59	3,010	0.07	89%	0.84
CCB-113	4,626	0.11	1,966	0.05	2,660	0.06	42%	0.55
YD-114 (WITH ROOF)	21,642	0.50	15,406	0.35	6,236	0.14	71%	0.73
YD-115	7,221	0.17	80	0.00	7,141	0.16	1%	0.31
YD-116	13,876	0.32	1,015	0.02	12,861	0.30	7%	0.34
YD117	5,039	0.12	455	0.01	4,584	0.11	9%	0.35
EXISTING YD	7,324	0.17	1,458	0.03	5,866	0.13	20%	0.42

Project: North System Isolator Row

Chamber Model -	SC-740	
Units -	**Imperial**	Click Here for Metric
Number of chambers -	44	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	47.25	ft
Amount of Stone Above Chambers -	6	in
Amount of Stone Below Chambers -	6	in
	1487	

☐ Include Perimeter Stone in Calculations

StormTech SC-740 Cumulative Storage Volumes

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Total Chamber *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch & St *(cubic feet)*	Cumulative Chamber *(cubic feet)*	Elevation *(feet)*
42	0.00	0.00	49.58	49.58	3295.44	50.75
41	0.00	0.00	49.58	49.58	3245.86	50.67
40	0.00	0.00	49.58	49.58	3196.28	50.58
39	0.00	0.00	49.58	49.58	3146.70	50.50
38	0.00	0.00	49.58	49.58	3097.12	50.42
37	0.00	0.00	49.58	49.58	3047.54	50.33
36	0.05	2.42	48.61	51.03	2997.96	50.25
35	0.16	7.17	46.71	53.88	2946.93	50.17
34	0.28	12.41	44.62	57.02	2893.05	50.08
33	0.60	26.57	38.95	65.52	2836.03	50.00
32	0.80	35.28	35.47	70.74	2770.50	49.92
31	0.95	41.83	32.85	74.68	2699.76	49.83
30	1.07	47.28	30.67	77.95	2625.08	49.75
29	1.18	51.94	28.80	80.74	2547.14	49.67
28	1.27	55.69	27.30	82.99	2466.39	49.58
27	1.36	59.62	25.73	85.35	2383.40	49.50
26	1.45	63.98	23.99	87.97	2298.05	49.42
25	1.52	67.09	22.74	89.83	2210.08	49.33
24	1.58	69.62	21.73	91.35	2120.25	49.25
23	1.64	72.26	20.68	92.94	2028.89	49.17
22	1.70	74.78	19.67	94.45	1935.96	49.08
21	1.75	77.13	18.73	95.86	1841.51	49.00
20	1.80	79.32	17.85	97.17	1745.65	48.92
19	1.85	81.62	16.93	98.55	1648.48	48.83
18	1.89	83.30	16.26	99.56	1549.93	48.75
17	1.93	85.10	15.54	100.64	1450.37	48.67
16	1.97	86.90	14.82	101.72	1349.74	48.58
15	2.01	88.44	14.20	102.64	1248.02	48.50
14	2.04	89.98	13.59	103.57	1145.37	48.42
13	2.07	91.30	13.06	104.36	1041.81	48.33
12	2.10	92.62	12.53	105.15	937.45	48.25
11	2.13	93.80	12.06	105.86	832.30	48.17
10	2.15	94.77	11.67	106.44	726.44	48.08
9	2.18	95.79	11.26	107.05	620.00	48.00
8	2.20	96.73	10.89	107.62	512.95	47.92
7	2.21	97.12	10.73	107.85	405.33	47.83
6	0.00	0.00	49.58	49.58	297.48	47.75
5	0.00	0.00	49.58	49.58	247.90	47.67
4	0.00	0.00	49.58	49.58	198.32	47.58
3	0.00	0.00	49.58	49.58	148.74	47.50
2	0.00	0.00	49.58	49.58	99.16	47.42
1	0.00	0.00	49.58	49.58	49.58	47.33

Project: South System Isolator Row

Chamber Model -	SC-740	
Units -	**Imperial**	Click Here for Metric
Number of chambers -	30	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	43.75	ft
Amount of Stone Above Chambers -	6	in
Amount of Stone Below Chambers -	6	in
	1020	

☐ Include Perimeter Stone in Calculations

StormTech SC-740 Cumulative Storage Volumes

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Total Chamber *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch & St *(cubic feet)*	Cumulative Chamber *(cubic feet)*	Elevation *(feet)*
42	0.00	0.00	33.80	33.80	2246.89	47.25
41	0.00	0.00	33.80	33.80	2213.09	47.17
40	0.00	0.00	33.80	33.80	2179.28	47.08
39	0.00	0.00	33.80	33.80	2145.48	47.00
38	0.00	0.00	33.80	33.80	2111.67	46.92
37	0.00	0.00	33.80	33.80	2077.87	46.83
36	0.05	1.65	33.14	34.79	2044.07	46.75
35	0.16	4.89	31.85	36.74	2009.27	46.67
34	0.28	8.46	30.42	38.88	1972.53	46.58
33	0.60	18.12	26.56	44.68	1933.66	46.50
32	0.80	24.05	24.18	48.24	1888.98	46.42
31	0.95	28.52	22.40	50.92	1840.74	46.33
30	1.07	32.24	20.91	53.15	1789.83	46.25
29	1.18	35.41	19.64	55.05	1736.68	46.17
28	1.27	37.97	18.62	56.59	1681.63	46.08
27	1.36	40.65	17.54	58.19	1625.04	46.00
26	1.45	43.62	16.35	59.98	1566.85	45.92
25	1.52	45.74	15.51	61.25	1506.87	45.83
24	1.58	47.47	14.82	62.29	1445.62	45.75
23	1.64	49.27	14.10	63.37	1383.34	45.67
22	1.70	50.99	13.41	64.40	1319.97	45.58
21	1.75	52.59	12.77	65.36	1255.58	45.50
20	1.80	54.08	12.17	66.25	1190.22	45.42
19	1.85	55.65	11.54	67.19	1123.96	45.33
18	1.89	56.79	11.09	67.88	1056.77	45.25
17	1.93	58.02	10.60	68.62	988.89	45.17
16	1.97	59.25	10.10	69.35	920.27	45.08
15	2.01	60.30	9.69	69.98	850.92	45.00
14	2.04	61.35	9.26	70.61	780.94	44.92
13	2.07	62.25	8.90	71.15	710.32	44.83
12	2.10	63.15	8.55	71.69	639.17	44.75
11	2.13	63.95	8.22	72.18	567.48	44.67
10	2.15	64.62	7.96	72.57	495.30	44.58
9	2.18	65.31	7.68	72.99	422.73	44.50
8	2.20	65.95	7.42	73.37	349.74	44.42
7	2.21	66.22	7.32	73.54	276.36	44.33
6	0.00	0.00	33.80	33.80	202.83	44.25
5	0.00	0.00	33.80	33.80	169.02	44.17
4	0.00	0.00	33.80	33.80	135.22	44.08
3	0.00	0.00	33.80	33.80	101.41	44.00
2	0.00	0.00	33.80	33.80	67.61	43.92
1	0.00	0.00	33.80	33.80	33.80	43.83

Project: **One Park West Hartford - North**

Chamber Model -	SC-740	
Units -	**Imperial**	Click Here for Metric
Number of chambers -	286	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	46.75	ft
Amount of Stone Above Chambers -	6	in
Amount of Stone Below Chambers -	6	in
Area of system -	10706	sf Min. Area - 9668 sf min. area

☑ Include Perimeter Stone in Calculations

StormTech SC-740 Cumulative Storage Volumes

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Total Chamber *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch & St *(cubic feet)*	Cumulative Chamber *(cubic feet)*	Elevation *(feet)*
42	0.00	0.00	356.87	356.87	22873.56	50.25
41	0.00	0.00	356.87	356.87	22516.70	50.17
40	0.00	0.00	356.87	356.87	22159.83	50.08
39	0.00	0.00	356.87	356.87	21802.96	50.00
38	0.00	0.00	356.87	356.87	21446.10	49.92
37	0.00	0.00	356.87	356.87	21089.23	49.83
36	0.05	15.73	350.58	366.30	20732.36	49.75
35	0.16	46.59	338.23	384.82	20366.06	49.67
34	0.28	80.64	324.61	405.25	19981.24	49.58
33	0.60	172.73	287.77	460.51	19575.99	49.50
32	0.80	229.29	265.15	494.44	19115.48	49.42
31	0.95	271.89	248.11	520.00	18621.04	49.33
30	1.07	307.31	233.94	541.25	18101.04	49.25
29	1.18	337.62	221.82	559.44	17559.79	49.17
28	1.27	361.98	212.08	574.05	17000.35	49.08
27	1.36	387.53	201.85	589.39	16426.29	49.00
26	1.45	415.87	190.52	606.39	15836.91	48.92
25	1.52	436.07	182.44	618.51	15230.52	48.83
24	1.58	452.55	175.85	628.39	14612.01	48.75
23	1.64	469.69	168.99	638.68	13983.61	48.67
22	1.70	486.06	162.44	648.50	13344.93	48.58
21	1.75	501.34	156.33	657.67	12696.43	48.50
20	1.80	515.60	150.62	666.23	12038.76	48.42
19	1.85	530.53	144.65	675.18	11372.53	48.33
18	1.89	541.42	140.30	681.72	10697.35	48.25
17	1.93	553.13	135.62	688.74	10015.62	48.17
16	1.97	564.85	130.93	695.78	9326.88	48.08
15	2.01	574.84	126.93	701.77	8631.11	48.00
14	2.04	584.87	122.92	707.79	7929.34	47.92
13	2.07	593.44	119.49	712.93	7221.55	47.83
12	2.10	602.01	116.06	718.07	6508.62	47.75
11	2.13	609.69	112.99	722.68	5790.55	47.67
10	2.15	616.00	110.47	726.47	5067.87	47.58
9	2.18	622.64	107.81	730.45	4341.40	47.50
8	2.20	628.73	105.37	734.10	3610.95	47.42
7	2.21	631.30	104.35	735.64	2876.84	47.33
6	0.00	0.00	356.87	356.87	2141.20	47.25
5	0.00	0.00	356.87	356.87	1784.33	47.17
4	0.00	0.00	356.87	356.87	1427.47	47.08
3	0.00	0.00	356.87	356.87	1070.60	47.00
2	0.00	0.00	356.87	356.87	713.73	46.92
1	0.00	0.00	356.87	356.87	356.87	46.83

Project: **One Park West Hartford - South**

Chamber Model -	SC-740	
Units -	**Imperial**	Click Here for Metric
Number of chambers -	360	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	43.25	ft
Amount of Stone Above Chambers -	6	in
Amount of Stone Below Chambers -	6	in
Area of system -	13650	sf Min. Area - 12170 sf min. area

☑ Include Perimeter Stone in Calculations

StormTech SC-740 Cumulative Storage Volumes

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Total Chamber *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch & St *(cubic feet)*	Cumulative Chamber *(cubic feet)*	Elevation *(feet)*
42	0.00	0.00	455.00	455.00	29035.38	46.75
41	0.00	0.00	455.00	455.00	28580.38	46.67
40	0.00	0.00	455.00	455.00	28125.38	46.58
39	0.00	0.00	455.00	455.00	27670.38	46.50
38	0.00	0.00	455.00	455.00	27215.38	46.42
37	0.00	0.00	455.00	455.00	26760.38	46.33
36	0.05	19.80	447.08	466.88	26305.38	46.25
35	0.16	58.65	431.54	490.19	25838.50	46.17
34	0.28	101.50	414.40	515.90	25348.31	46.08
33	0.60	217.43	368.03	585.46	24832.41	46.00
32	0.80	288.62	339.55	628.17	24246.96	45.92
31	0.95	342.24	318.10	660.35	23618.79	45.83
30	1.07	386.83	300.27	687.10	22958.44	45.75
29	1.18	424.98	285.01	709.99	22271.35	45.67
28	1.27	455.64	272.75	728.38	21561.36	45.58
27	1.36	487.80	259.88	747.68	20832.98	45.50
26	1.45	523.48	245.61	769.09	20085.30	45.42
25	1.52	548.90	235.44	784.34	19316.21	45.33
24	1.58	569.64	227.15	796.78	18531.87	45.25
23	1.64	591.22	218.51	809.73	17735.09	45.17
22	1.70	611.83	210.27	822.10	16925.35	45.08
21	1.75	631.05	202.58	833.63	16103.26	45.00
20	1.80	649.01	195.40	844.41	15269.63	44.92
19	1.85	667.80	187.88	855.68	14425.22	44.83
18	1.89	681.51	182.40	863.91	13569.54	44.75
17	1.93	696.24	176.50	872.75	12705.63	44.67
16	1.97	711.00	170.60	881.60	11832.89	44.58
15	2.01	723.57	165.57	889.14	10951.29	44.50
14	2.04	736.20	160.52	896.72	10062.14	44.42
13	2.07	746.99	156.21	903.19	9165.43	44.33
12	2.10	757.77	151.89	909.66	8262.23	44.25
11	2.13	767.45	148.02	915.47	7352.57	44.17
10	2.15	775.39	144.85	920.23	6437.11	44.08
9	2.18	783.74	141.50	925.25	5516.87	44.00
8	2.20	791.41	138.44	929.85	4591.63	43.92
7	2.21	794.64	137.15	931.78	3661.78	43.83
6	0.00	0.00	455.00	455.00	2730.00	43.75
5	0.00	0.00	455.00	455.00	2275.00	43.67
4	0.00	0.00	455.00	455.00	1820.00	43.58
3	0.00	0.00	455.00	455.00	1365.00	43.50
2	0.00	0.00	455.00	455.00	910.00	43.42
1	0.00	0.00	455.00	455.00	455.00	43.33

APPENDIX D

Stormwater Quality Calculations

STORMWATER QUALITY CALCULATIONS

Methodology: Water Quality Volume and Flow

Reference: 2004 Stormwater Quality Manual

WQV = (1")(R)(A)
12

WQV= water quality volume *(acre-feet)*
R= volumetric runoff coefficient
I = percent impervious cover
A= site area *(acres)*

WQF = (q_u)(A)(Q)

WQF = water quality flow *(cfs)*
q_u= unit peak discharge *(cfs/mi²/inch)*
A= drainage area *(mi²)*
Q= runoff depth *(watershed inches)*
= [WQV *(acre-feet)*]x[12*(inches/foot)*]
Drainage area *(acres)*

Site Characteristics (Water Quality Unit - PR-A1)

Area	3.44	acres	0.005375 mi^2
Impervious Area	2.47	acres	
I	71.8	%	
R = 0.05+ 0.009(I) =	0.696		
WQV=	**0.20**	**acre-ft**	8,694 cf

P=Precipitation	1	inch	
Ia=Initial Abstraction	0.284		
Tc=Time of Concentration	8	minutes	0.133333 hours

Qu=unit peak discharge (Exhibit 4-III)	575	cfs/mi^2/inch	
A=Drainage Area	3.44	acres	0.005375 mi^2
Q=Runoff Depth	0.7	watershed inches	
WQF=	**2.15**	**cfs**	

One Park Road	BY	JM	DATE	12/06/20183	PROJ NO. 140184201
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STORMWATER QUALITY CALCULATIONS

Methodology: Water Quality Volume and Flow

Reference: 2004 Stormwater Quality Manual

WQV = (1")(R)(A)
12

WQV= water quality volume *(acre-feet)*
R= volumetric runoff coefficient
I = percent impervious cover
A= site area *(acres)*

WQF = (q_u)(A)(Q)

WQF = water quality flow *(cfs)*
q_u= unit peak discharge *(cfs/mi²/inch)*
A= drainage area *(mi²)*
Q= runoff depth *(watershed inches)*
= [WQV *(acre-feet)*]x[12*(inches/foot)*]
Drainage area *(acres)*

Site Characteristics (Water Quality Unit - PR-A1)

Area	4.62	acres	0.007219	mi^2
Impervious Area	3.39	acres		
I	73.4	%		
R = 0.05+ 0.009(I) =	0.710			
WQV=	**0.27**	**acre-ft**	11,914	cf

P=Precipitation	1	inch		
Ia=Initial Abstraction	0.269			
Tc=Time of Concentration	12	minutes	0.2	hours

Qu=unit peak discharge (Exhibit 4-III)	575	cfs/mi^2/inch		
A=Drainage Area	4.62	acres	0.007219	mi^2
Q=Runoff Depth	0.7	watershed inches		
WQF=	**2.95**	**cfs**		

One Park Road	BY	JM	DATE	12/6/2018	PROJ NO. 140184201
West Hartford, CT	CKD		DATE		SHEET 1 of 1

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